ELECTRICAL REVIEW

ILLUSTRATED.

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Wages of a Telegraph Operator.

In the case of Boyle, *et al.*, *vs.* Vanderhoof, recently decided by the Supreme Court of Minnesota, it appeared that the wages of the appellee, a telegraph operator, were garnisheed by his creditors, and he claimed that his wages were exempt under the act of 1889, providing that the wages of any person, or minor children of such person, in any sum not exceeding $25 for any service not exceeding 30 days previous to the issue of a process, should be exempt. The court below held that the terms of the act were intended to apply to servants and day laborers. The Supreme Court reversed this judgment, saying: "The title is not carefully worded, but we think the word laborer, as used in connection with wages, may in a general use be applied to employés other than workingmen engaged in manual labor consistently with the provisions of the act. And that being so, the court will so construe it in connection with the language used in the body of the act, and will, if necessary, give it the broader significance in order to uphold the constitutionality of the law."

Vermont Laws.

Here are the laws in the State of Vermont relating to telephone and telegraph companies:

Every corporation, joint stock company, person or persons doing telephone business in this State, shall pay a tax to the State, which is hereby assessed at the rate of three per cent. annually on the gross receipts of all their business earned wholly within this State, including sums received for rental of instruments, but there shall be deducted from such gross receipts the amount paid by such corporation, company or persons to any telegraph company with whom they are connected for the transmission of messages.

Every corporation, company, person or persons, owning or operating a telegraph line or doing telegraph business in this State shall pay a tax to the State treasurer, which is hereby assessed at the rate of 10 per cent. annually of the gross receipts of all their business, and earned wholly within this State.

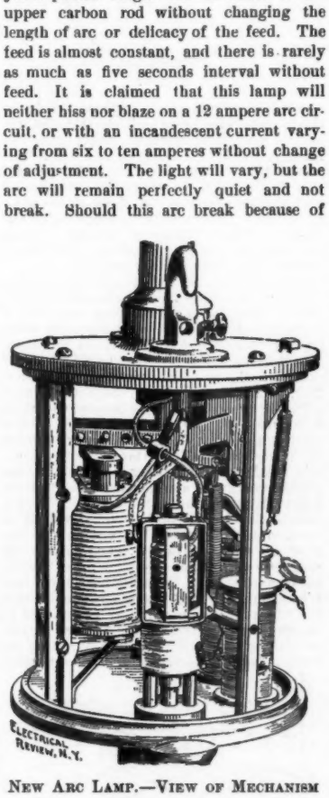
The Electric Cane.

The electric cigar case, capable of shocking a person into insensibility, which some time ago went the round of the newspapers in this country, much to the amusement of scientific readers, has now cropped up again in Europe. This time it has taken on the form of an electric cane, said to be the invention of a French engineer, who offers this formidable weapon as a substitute for the revolver, with the statement that by pressing a spring in the knob of the cane, the peaceable citizen who carries it can administer to any would-be assailant a shock strong enough to render him unconscious for the time being. It was ever thus. Europe is bound to follow the lead of America in electrical inventions. In the present case, however, we doubt whether the electric cane is likely to be any more effective as a weapon of offense or defense than the electric cigar case of innocuous memory.

A Riverside, Cal., man has arranged an electric frost alarm which will be a great convenience to orange growers. It consists of an accurate dial thermometer, electrically connected with a bell and switch in such a manner that it will cause the bell to ring when any desired temperature is reached.

Giles' Arc Lamp.

There are probably but few practical electricians who have not labored more or less on the difficult problem of running a series of arc lamps on circuits of constant potential. It is generally believed this cannot successfully be done. It is claimed that the Giles lamp, just patented, does its work equally well upon arc or incandescent circuits. It has a very delicate feed controlled by a rack practically without friction, and yet a pound weight can be added to the upper carbon rod without changing the length of arc or delicacy of the feed. The feed is almost constant, and there is rarely as much as five seconds interval without feed. It is claimed that this lamp will neither hiss nor blaze on a 12 ampere arc circuit, or with an incandescent current varying from six to ten amperes without change of adjustment. The light will vary, but the arc will remain perfectly quiet and not break. Should this arc break because of



NEW ARC LAMP.—VIEW OF MECHANISM

impurities in the carbons, the action of the lamp is so quick that no interval of darkness results—it is but a wink too brief to attract attention. The switch in a circuit of two of these lamps on a 110 volt circuit can be opened and closed, and a perfectly quiet arc will follow.

We noticed in a late issue a small magnetic device invented by Mr. Giles, to be placed in a circuit with a series of these lamps when used on incandescent circuits. All carbons contain more or less of impurities that will cause an occasional spit. This is rarely noticed on a regular arc circuit, but when the same carbons are used in series on a constant potential circuit this fault is fatal, as this spit is followed by a hiss and blowing, and lamps adjusted and burning at eight amperes will instantly pass to 18 or 20 amperes. When this blowing ceases, the arc usually breaks. The larger Edison stations, such as those of New York, Brooklyn, Boston, Philadelphia and others, with their large and flexible output, might be induced to put up with these sudden vibrations; but in country stations, where such changes would be noticeable, both on the incandescent lamp and the station indicators, the difficulty assumes greater importance. This little circuit check is introduced to obviate this trouble by practically anticipating trouble in the arc, and preserving the current at a uniform strength.

The accompanying cut will give a general idea of the arc lamp. The arc springing device consists of the main magnet and lever carrying a wheel and pinion. Between the magnet keeper and the upper face of the coils is a leaf spring laid on the face of coils. This forms a cushion to slightly vary the length of arc, due to any sudden fluctuation of current. This magnet carries the upper carbon and rod, retractile spring, etc., and, therefore, all friction is put upon the strongest member. The shunt coils occupy the opposite side of the lamp. The cores of these coils are suspended from an arm pivoted across the diameter of the lamp frame, the cores being rigidly attached to this arm, and are thereby prevented from touching the inside of the coils. The arm extends just beyond the keeper forming a rack, engaging a light spiral spring suspended from a threaded bolt, rendering the adjustment of the lamp the work of but a few seconds, and leaving the action of the shunt core perfectly free from friction. The core keeper carries a knife edge, which engages quite a long lever projecting from the anchor of the clock escapement, thus placing the feed entirely under the control of the resistance of the arc, unencumbered with the friction of moving parts. The main arm locks and unlocks the escapements. When the main magnet is unattracted, the carbon rod is free to move up and down throughout its entire length. The cut-out is adapted to operate on the shunt circuit when the lamp is on a constant potential circuit, and on the main circuit when on a constant current system. These lamps have been in practical operation for about 18 months in the office of the inventor.

Storage Battery Street Cars as a Business Enterprise.

The Metropolitan Street Railroad Company, Washington, has decided to change the entire equipment of its main line from horse cars to storage battery cars. It is now building the first installment of cars and preparing to commence the erection of an extensive power station. This will be located on Rock Creek, between Washington and Georgetown, where the company some time ago purchased a large block of land adjoining its present car stables. About 40 cars will be required on this line, and they will be put in operation, probably in lots of five, as fast as they can be gotten ready and as soon as the station is started. Engineer Mailloux's motors and gearing will be used. This part of the equipment is to be manufactured at Baltimore by Mr. G. W. S. Baker, president of the Baltimore Car Wheel Company, who has established a factory for the business. It is expected the first cars will be running in the course of three or four months. This undertaking has been decided upon after the most thorough and exhaustive investigation of the whole subject of street car propulsion and nearly a year's experimenting with Mr Mailloux's invention and the Accumulator Company's batteries. President Pearson is one of the most experienced and successful street railway managers in the country, and he has satisfied himself and his stockholders that they have caught up with the "motor of the future."

Visit to a Great Electric Light Station.

The members of the Department of Electricity of the Brooklyn Institute and their friends, were invited by the officers of the Citizens' Electric Illuminating Company, last Friday evening, to inspect the plant of this company on DeKalb and Hudson avenues. The guests, on arriving, were met by Mr. E. F. Peck, superintendent, and his assistants, and taken through this most interesting station. The first visit was to the boiler room, where the power is supplied by nine boilers, manufactured and put up by the Logan Iron Works, of Brooklyn. The boilers are fitted with Stead generators, a system of pipes or drums surrounding the fire in the boiler giving increased steam service, which increases the capacity of the boilers 33⅓ per cent. Lock damper regulatbrs and feedwater heaters assist in the competent firing of this station.

From the boiler room the party were then conducted to the handsome engine room, where there are two 350 horse-power Wright-Corliss engines, and one 450 horse-power of the same type, driving the dynamos above by means of two 42-inch three-ply, and four 36-inch two-ply, "electric" belts, manufactured by Charles A. Schieren & Company. The steam recording and indicating is done by means of the Edson recording steam gauge. Chief Engineer W. H. Bowne is in charge of the engine and boiler room.

Over the engine room is the dynamo room, switchboard, arc light and incandescent light testing room. The plant consists of thirty-six 45 light Thomson-Houston, and one 30 light Excelsior, dynamos. The switchboard contains 48 circuits, and is so arranged that, in case of a wire being cut in street, it is shown at once on the machine, and the broken circuit can easily and quickly be changed on switchboard to another circuit. The arc light testing room, in which all lamps are tested before sending out and repaired when broken, is in charge of Mr. Anthony Moran. The incandescent light testing room was next visited, and Mr. William Kuehn, the assistant superintendent, was found busy explaining the working of the incandescent lamp system, run on arc circuit, to his many visitors. In this room there were in circuit lamps from 25 to 75 candle-power. Under usual conditions, as soon as a lamp breaks, or air is admitted into the bulb, it would tend to open circuit. In such a contingency the circuit is completed around the lamp by a device in the socket, where two conducting points are separated and insulated from each other by a thin piece of paper which is punctured by the current on an abnormal rise of E.M.F. due to breakage of lamp, and permits the circuit to be completed independently of the filament. One of the most interesting experiments shown in this room was the breaking of a bulb, admitting air into it and putting it in circuit where it would still burn for a few seconds or until the carbon had been burned up. In the incandescent light testing room there are also 30 cells Julien storage battery which furnish incandescent lamps to light the station after shutting down in the morning or during the day. After inspecting the entire works, the party was conducted to the offices of the company on Hudson avenue, where a delightful lunch was served and the plans for the new building, which the company is about to build, inspected. The party left, congratulating Mr. Peck and his assistants, who had done so much towards making it an agreeable and highly interesting evening to the visitors.

The officers of the company are: President, Hon. John Delmar; secretary and treasurer, T. F. Nevins, who is also president of the State Electric Light Association; superintendent, Edward F. Peck.

Electro-Magnetic Radiation.

BY PROF. A. L. KIMBALL, PH.D.

It has been known for many years that electrical oscillations existed, but it remained for Prof. Hertz to show how the electrical waves given off from a conductor might be detected and studied. The method of which he was the discoverer depends on what may be called *electrical resonance.*

It was discovered by Hertz that if two electrical conductors are taken of such sizes and shapes that the time of electrical oscillation in the one is the same as in the other, when strong electrical vibrations are set up in one the other will also have an electric disturbance sympathetically excited. It is by making use of this fact that he was able to demonstrate the existence of electro-magnetic waves and to measure wave lengths.

It will be well to examine briefly how some of the more important results have been demonstrated. Hertz apparatus involved what we shall call the vibrator and the resonator. In his earlier experiments the vibrator consisted of two sheets of tin, A and B (Fig. 1), about a foot square, provided with knobs and separated by a small gap C. These plates were connected one with each pole of a powerful induction coil D. The resonator (Fig. 2) was simply a hoop of wire, in which there was left a gap, the terminals being made of little knobs, whose distance apart could be accurately adjusted by means of a micrometer screw.

When the induction coil was made to act, the plates A B were charged and discharged by sparks across the gap C.

The resonator E was made of such a size and shape that the period of electrical vibrations in it might be the same as in the vibrator, and the adjustment was finally made by changing the sizes of the knobs until the best effect was obtained.

But how can it be established that these effects are really due to waves, and how can

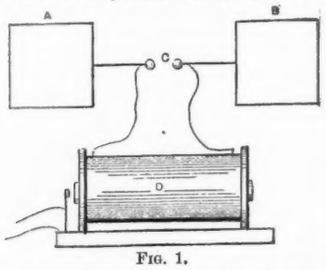


FIG. 1.

the wave lengths be measured? The characteristic phenomenon by which the existence of waves is recognized is *interference.* That is, two waves may come together in such a way that one shall exactly neutralize the effect of the other, or by slightly changing their relative *phases* they may reinforce each other. In case of water waves, for example, if two sets of waves are coming from separate points, there will be certain points where the crests of the two sets of waves will arrive simultaneously; these will be points of great disturbance; there will be other points where the crests of one set of waves will arrive at the same instant as the troughs of the other set of waves; these will be points of minimum distribution, for one set of waves will largely or entirely neutralize the effect of the other set. These are what are known as *interference* effects, and it is by these interference effects in case of light that it is known to be a wave motion, and that the wave lengths are measured. It at once became a point of peculiar interest to discover whether such effects could not be demonstrated in case of electro-magnetic waves, and the discovery of these interference effects by Hertz established beyond all question the existence of electro-magnetic waves.

In one experiment the vibrator sending out the waves was placed directly opposite and at a distance of 40 feet from a wall which had been covered with sheet metal, and so was a good reflector. The reflected waves meeting those coming directly from the vibrator gave rise to interference, producing what are analogous to the nodes and loops set up when a sounding tuning fork is held in front of a reflecting wall.

In an electro-magnetic wave there are two elements to be considered—the electric currents and the magnetic inductors; and, thinking of it again, according to the mechanical analogy previously discussed, it is evident that the one will be a maximum when the other is a minimum.

In an ordinary sound wave the points of rarefaction and condensation are places where the air particles are moving with greatest *velocity,* while midway between them where the density of the air in the wave is normal, the *displacement* of the air particles from their equilibrium positions is greatest. When a sound wave is reflected from a hard surface, a node or point of rest of the air particles is found at the surface, another such node or point of rest is found at a distance of one-half a wave length from the reflecting surface by the interference of the advancing with the reflected wave, and between these two nodes there is what is called a loop or point where the motion of the air particles is a maximum; and so on, we find nodes and loops succeeding each other in regular order, the distance between two successive nodes being half the length of the wave. But while the nodes are places of minimum motion they are points where the change in density of the air is a maximum. So in the case of electro-magnetic waves when reflected from the surface of a conductor; at that surface the changes in magnetic induction will be a maximum, while the changes in the electric displacement will be a minimum; a half wave length from the conducting surface this will be changed; there will be no magnetic induction, while the changes in the electric displacement will be a maximum, and so on alternately, thus constituting electro-magnetic nodes and loops. In Fig. 3 the state of things near the reflecting wall in Hertz's experiment is represented, the distance being indicated in metres on the scale at the bottom of the diagram. The vibrator sending out the wave is supposed to be off at the right, with its axis vertical and parallel to the paper, so that in the waves represented electric displacements are up and down in the place of the paper, while the magnetic lines of induction are perpendicular to the paper.

If at some point on the line from the vibrator perpendicular to the reflecting surface the circle of wire used as a resonator is placed with its plane parallel to the reflecting surface, and with the spark gap neither at the top nor bottom, but at one side, the effect observed will be wholly independent of the magnetic lines of force, since none of them will go through the circle, and since in that position the electric displacements are the same at all points of the circle, the effect will depend only on the intensity of the changes in the displacements; the circle may therefore be used in this way to compare the intensities of the displacement currents at different points. On performing the experiment in this way, Hertz found that there was scarcely any sparking when the resonator was near the wall, but that it increased in intensity on carrying it away, reaching a maximum at B, then diminished again to a minimum at C, and finally increased as the circle was moved toward D; the periodicity could not be traced farther, owing to the preponderance of the direct waves as the vibrator was approached more nearly. This experiment indicated that the electric displacement was a minimum at the wall, a maximum at the distance B, again a minimum at C, etc., indicating that the distance from B to C was one-quarter of a wave length. In this way the length of the wave was found to be 9.3 metres. It will be noticed that in the diagram (Fig. 3) the distance from B to the wall is rather less than from B to C. This is due to the fact that the point at the reflecting surface is not exactly a node, owing to the surface not being a perfect conductor, so that there were slight displacement currents even close to the reflector. That this is the explanation of the observed phenomena was further shown by determining in a similar way the points where the changes in the magnetic intensity were a maximum. For this purpose the resonator or circle is held with its plane vertical and perpendicular to the reflecting plane, or just as represented in positions I, II, III, IV in the diagram, except that the spark gap was at the top or bottom instead of at the side as in the case indicated. In this position of the circle the electric displacements being up and down, have scarcely any influence in causing sparking to take place at the gap; but the magnetic lines of force, being at right angles to the coil, pass through it, and hence changes in the magnetic induction at the point where the circle is placed, give rise to electromotive forces acting around the circle and causing sparks to leap the gap. In this position, therefore, the greatest sparking will be observed where the changes in magnetic induction are greatest. Observation showed marked sparking at the reflecting surface, which fell rapidly to zero as B was approached, increased again to a maximum at C, then diminished to a second minimum at D, and finally increased as the circle was moved beyond D nearer to the vibrator, the disturbing influence of the neighborhood of the vibrator being felt as before. These two experiments gave independently the length of the waves sent out by the vibrator, and, in accordance with theory, showed that the maxima for changes in magnetic induction lay between the points where the electric displacement currents were a maximum. The diagram illustrates this point, vertical distances between dotted lines representing the intensity of the change in magnetic induction, and the same for the solid lines, giving the intensities of the displacement currents. By these experiments the fact that we are here dealing with a wave motion may be regarded as established and the length of the wave determined. The time of vibration of the electric currents in the vibrator was calculated by Hertz from the form and dimensions of the apparatus as about 2.8 hundred-millionths of a second. If the wave length is divided by the period of vibration the velocity of the wave is obtained. Taking the figures given, we obtain thus 332,000,000 metres per second as the velocity of the wave; but the velocity of light is 300,000,000 metres per second, and the difference between the two may be readily due to an error in the calculated period of vibration of the apparatus, that being a quantity which cannot be accurately computed. It may be concluded, then, that so far as the velocity of the wave is determined by these experiments, they point to the same velocity as that of light.

It is well known that electro-magnetic disturbances are communicated from the sun to the earth, as shown in the magnetic disturbances accompanying great sun spot activity. This indicates that some medium fills the region between the earth and sun which is capable of communicating these electro-magnetic disturbances, but the medium known as the luminiferous ether, or simply the ether, fills all space as far as light can travel,

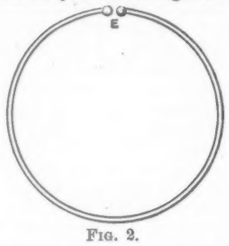


FIG. 2.

and it is more rational to suppose this to be the medium also by which electric disturbances are communicated rather than to imagine another medium, at least unless this supposition can be disproved. But the fact that electro-magnetic waves are propagated with the same velocity as light waves is almost proof positive of the correctness of the view, since the velocity of a wave depends on the properties of the medium in which it exists, as has been already noted.

Electro-magnetic waves are, then, ether waves; but light waves are also ether waves. What, then, is the difference between a wave of light and an electro-magnetic wave such as is sent out from a Hertz vibrator? The difference is believed to be solely one of wave length, or of the period of the vibration, only those electro magnetic waves affecting the eye as light whose wave length is between $\frac{1}{40000}$ of an inch and $\frac{1}{70000}$. The modern theory of electricity is characterized by its view of the importance of the dielectric medium. In looking at a dynamo supplying energy to a motor the current is no longer regarded as a fluid simply forced around the circuit and having no relation to the surrounding space, but not only is the flow of current always accompanied by magnetic whirls and electric stresses in the medium, but Prof. Poynting has shown that it is through the medium rather than through the wire that the energy is to be regarded as communicated. Thus at the dynamo energy is being given to the medium in setting up lines of magnetic force, and these spreading

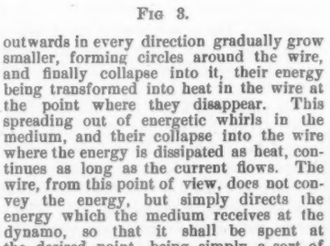


FIG 3.

outwards in every direction gradually grow smaller, forming circles around the wire, and finally collapse into it, their energy being transformed into heat in the wire at the point where they disappear. This spreading out of energetic whirls in the medium, and their collapse into the wire where the energy is dissipated as heat, continues as long as the current flows. The wire, from this point of view, does not convey the energy, but simply directs the energy which the medium receives at the dynamo, so that it shall be spent at the desired point, being simply a sort of leading string for the energy in providing a place where it may be dissipated in the form of heat, or, as in the motor, in mechanical work. Electrical science may, therefore, almost be called the science of the ether, for when a magnet attracts a weight it is forced up by the stresses in the ether, and even when a street car moves by a motor it is these same strains and stresses in the ether originating at the dynamo which urge it along.—*London Electrician.*

Electrolytic Administration of Medicine.

BY FREDERICK PETERSON, M. D.

In a paper of mine, published in the New York *Medical Journal,* April 27, 1889, there are figured two cataphoretic electrodes devised for the anodal diffusion of drugs through the skin. The great drawback, until this present moment, has been the difficulty of accurately regulating the amount of drug introduced. For this purpose rather complicated electrodes have hitherto been required, and even these have been unsatisfactory. I have recently found, however, that all difficulties are easily obviated by the use of a new and exceedingly simple method. Messrs. Waite and Bartlett have made for me a cataphoretic electrode of metal. Instead of covering it, as before, with sponge, the ordinary metal surface is overlaid with a thin disk of platinum, and around the edge of this is placed a narrow rim of soft rubber. The drug to be used is put drop by drop upon a disk of ordinary tissue paper cut to fit the disk of platinum. Filtering paper or linen cloth may be used instead of tissue paper. A disk, two or three centimetres in diameter, will hold from one to four drops of the solution. When the medicated disk is placed upon the metal surface of the electrode, and the latter then applied to the skin, it is evident that there is a thin capillary layer of the drug in solution exposed to the cataphoretic power of the anode, between the electrode and the skin, and that the quantity of the drug used may be accurately estimated. The current is allowed to flow, if desired, until the medicated disk becomes perfectly dry. In this way we may drive in one or more drops of chloroform, methyl chloride, ether, 10 to 20 per cent. solutions of cocaine, a one per cent. solution of helleborin, solutions of iodide of potassium, corrosive sublimate, aconitine—in fact, any drug we wish to employ in this manner; and at the same time we know exactly how much we are using.

To further simplify the method, I have had medicated cataphoretic disks prepared by a pharmacist for use at any time, for the paper disks may be charged with any amount of a watery solution, and, the water being allowed to evaporate, they may be kept on hand indefinitely. It is only necessary to add two or three drops of water to the disk in administering the drug by electricity.

Mr. Otto Boeddiker, the apothecary, of 954 Sixth Avenue, has made for me, and is prepared to supply any one with, the following cataphoretic disks; Disks of menthol, 2 grains; of helleborin, $\frac{1}{12}$ grain; of strychnine nitrate, $\frac{1}{12}$ grain; of iodol, 2 grains; of corrosive sublimate, $\frac{1}{8}$ grain; of cocaine hydrochloride, $\frac{3}{4}$ grain; of aconitine, $\frac{1}{12}$ grain; of potassium iodide, 4 grains; of mercury succinimide, $\frac{1}{4}$ grain; of lithium chloride, 4 grains.

The New Pulitzer Building.

This magnificent Park Row structure was thrown open for inspection to some 4,000 invited guests, Wednesday evening of last week. The building is to be the home of the New York *World,* and is undoubtedly the most complete structure for its purpose on the globe. A large number of distinguished people were present, and appreciation of the brilliant success of Mr. Joseph Pulitzer and his able associates, Col. John A. Cockerill, Geo. W. Turner and others, was given expression by many eminent gentlemen, including Governors Hill, Beaver, Campbell, Congressman Flower and others. A fine repast was served, and every department connected with the publication of the *World* was visited by interested crowds.

The Money Market Illustrated.

"Papa, give me a dollar."

"What for?"

"Oh, just to own."

"All right, Johnny. You can own this dollar I have in my pocket, but I'll play I'm a trust company and keep it for you."—*Harper's Bazar.*

The Versatile Reporter.

We had thought that the talented and versatile newspaper reporter had invented about all the possible causes of boiler explosions, but a new one comes from St. John, N. B., where a boiler exploded "with great violence" (as they nearly always do), killing six men and wrecking buildings. The dispatch says:

From what can be learned, the boilers were low, the water was turned on, and the person in charge neglected to turn it off, with the result that the boilers overflowed and exploded.

From this it will be seen that it is very dangerous to allow boilers to overflow.—*American Machinist.*

VIEWS, NEWS AND INTERVIEWS.

"Platinum is now quoted at $16 an ounce," said Mr. Daniel W. Baker, the senior member of the firm of Baker & Company, Newark, N. J., probably the largest dealers in platinum in the world. "A short time ago $20 was the price, but the stringency in the money market and the approaching end of the year have made buyers hold off and caused the price to drop a little. Everything points to a rise in the price of platinum, with the opening of the new year."

"Have you heard that an English chemist is said to have discovered a substitute for platinum?"

"Yes, and I know a man here, in Newark, who claims the same thing, but I have never seen any of the material. I would not presume to say, of course, that such a discovery is impossible, but I do think it is highly improbable. Platinum, you know, possesses two properties peculiar to itself, which render it especially adaptable for use in incandescent lamps. One of these is, that when subjected to heat, it expands in precisely the same ratio as glass, and the other is, that it is infusible. Any substitute for the precious metal must necessarily possess these properties in the same degree."

"A few years ago," remarked a Newark electrical engineer, "when the first lighting and power station was built here, we had hard work to get anybody to take the light. They were prejudiced and didn't want it at any price. To day we can't supply the demand for light, and the demand for electric power is simply enormous. If we had another 2,000 horse-power station ready today, I am sure we could dispose of the whole capacity by Christmas."

"The tight money market and the new tariff bill are affecting the electrical manufacturing companies to a considerable extent," said a man who keeps posted. "In all manufacturing lines which are seriously affected by the McKinley bill, electric light and power are the first items upon which economy is practiced. Both have been regarded as somewhat of a luxury until within a short time. This falling off in the trade is especially notable among the woolen mills. The financial troubles make it hard to float electric railway bonds, and this, of course, reacts on the companies supplying apparatus."

"The matter of subway rentals in New York city will be decided by the courts," observed city electrician Dr. Schuyler S. Wheeler. "I think the complaint of the electric light companies is a just one. An average price of 44 cents per lamp, per night, for arc lights, is not excessive and leaves the companies but a very small margin of profit. Last year I went over the documents and figures with Comptroller Meyers and in the light of that experience I make these statements."

"There is nothing new in my line," said Mr. Meadowcroft, of the Edison Lamp Works, at Harrison, N. J., "except that the recent cut in prices made by the Edison Company has caused a large influx of orders for our lamps. We are running both our old and new factory night and day to keep up with the procession."

"We did a good, average business last month," said Mr. Zimmerman, of the United States Electric Lighting Company, at Newark, N. J., "and our business so far, in the present month, points to an increase. We are working our factory day and night, and are about two months behind in our orders."

Big Judgment Against an Electric Light Contractor.

A judgment for $20,210.68 and $549.39 costs and disbursements in favor of the Utica, N. Y., Electric Light Company and against John H. Hapgood, of New York, was filed last week. Mr. Hapgood entered into a contract with the Utica Company to erect an electric lighting plant. The plaintiffs allege he failed to live up to his contract and asked $20,000 damages.

Testing the Centrality of Cable Cores.

BY PAUL LE GOAZIOU.

The following little apparatus has been devised to test the centrality of the copper conductors of submarine and subterranean cables:

The draw-plate, as I call it, consists of four copper rods, 1, 2, 3 and 4 (Fig. 1), arranged on a wooden or ebonite disk, B B^1, which is pierced with a hole at the center. These rods are 10 to 15 centimetres long, and can slide backwards and forwards on the disk, so that their ends can be made to press lightly against the insulation of the cable to be tested. In Fig. 2 we have a longitudinal section of the apparatus, from which it can be seen that a sort of funnel is screwed on to the back of the disk, B B^1, in

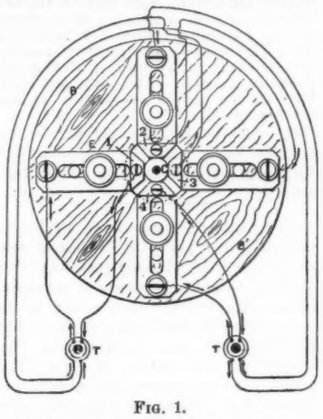


FIG. 1.

order to guide the cable through the telephonic draw-plate. The calibre of this funnel is, of course, different for different sizes of cables. Water is sometimes poured into this funnel to prevent heating, and if it is of great importance to reduce friction to minimum, the whole apparatus is placed in a vertical position.

Two differential telephones, T T^1 (Fig. 1), are connected as shown, that is to say, the front and back portions of rod 1 are connected to one part of the telephone T^1, while the front and back portions of the opposite rod 3 are connected to the other coil of the same telephone, and so on. While the cable is being passed through the telephonic draw-plate, a weak intermittent current is sent through its conductor. This intermittent current traversing the conductor of the cable induces Foucault currents in the copper rods. If the centrality of the cable conductor is perfect, it is obvious that the telephones will remain silent, but if the centrality of the conductor is imperfect, the rod nearest it has a stronger current generated

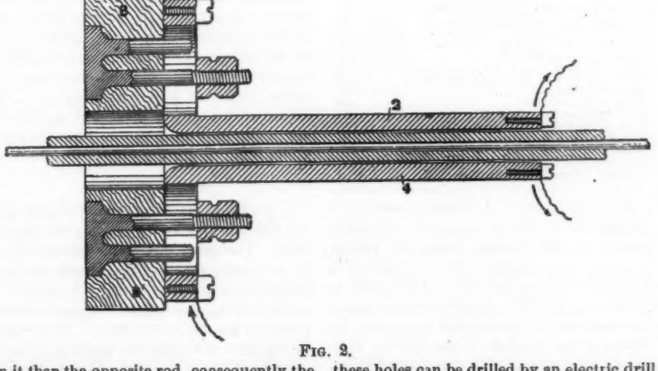


FIG. 2.

in it than the opposite rod, consequently the particular telephone, the coils of which are connected differentially to these two rods, will be affected.

Fig. 3 shows clearly the different cases that may arise. If the conductor is well in the center, as at *a*, nothing happens; if it is near rod 1, as at *b*, the coil connected to this rod is strongly affected acting on the telephone T. If the conductor is in the position shown at *c*, both the telephones, T and T^1, will speak. In the last case the position of the conductor can be determined by lightly turning the disk B, B^1, until the eccentric conductor has arrived at a position similar to that which it holds in *b*. In order to determine which rod the conductor is nearest to, it is only necessary to switch in a high resistance into the circuit of one of the differential coils. If the noise in the telephone is weakened, the cable conductor obviously lies nearest the rod into whose circuit the high resistance has been switched, and *vice versa*. The exact degree of eccentricity of the conductor can be determined by sliding back the rod nearest to the cable conductor. When the telephone is silent the two rods are obviously at the same distance from the inducing wire. The distance

FIG. 3.

traversed by the rod is then read off on a millimetre scale, which is engraved on the disk, and half this distance gives the distance of the conductor from the center of the cable. This postulates that the dielectric constants of air and gutta-percha are practically the same for currents of this order.

In carrying out this test in practice, the operator in charge has the telephone receivers fixed to his ears in the ordinary manner, and whenever he hears a noise in either of the telephones he marks the cable as it passes through the draw-plate with a dab of paint, and the cable is subsequently re-examined more carefully at these marked points.

In order to avoid the necessity of constructing two differential telephones, two ordinary telephones may be used. In this case the connections are as follows: The front ends of rods 1 and 3 (Fig. 1) are joined to the terminals of the telephone, and their other ends are joined together, rods 2 and 4 being similarly connected up. The same result is obtained by the circulation of opposite currents in the same coil as by the use of two distinct windings. This arrangement has, however, the inconvenience that if one wishes to determine exactly the degree of eccentricity of the cable conductor it is necessary to slide back one of the rods, which is a less rapid operation than merely switching in and out an additional resistance, as is done in the case of the differential telephones.

This little apparatus should prove of some use in testing the centrality of conductors of large cables. Up to the present the method employed somewhat resembles that of Alexander the Great when confronted with the Gordian knot; that is to say, the electrician charged with taking over the cable whenever he thinks the conductor is out of truth, chops the cable in two; if his suspicions prove correct, the contractor pays for repairs; if the electrician is wrong, the purchaser pays.

Electric Drills for Ship Building.

Electric drills are used with great success at Earle's Engineering and Shipbuilding Works, Hull, says the London *Electrical Engineer*. They are employed in drilling holes 2⅜ inches in diameter through the 2½-inch steel protective deck of H. M. SS. "Endymion" and "St. George." One of these holes can be drilled by an electric drill in about 20 minutes, while at the government dockyard, Devonport, it takes two men half a day to drill similar holes in a similar ship. The drill has been designed by Mr. W. H. Willatt, electrical engineer to the company. It stands on three legs, which are powerful compound electro-magnets, capable of lifting 1,000 pounds of iron each. To render the drill portable, eccentric wheel castors are attached to each leg. For drilling a hole the machine is brought over the place, the castors are turned up, and the magnets come in contact with the steel deck; the current is then switched on, and the magnets grip the deck. A motor on the machine operates the drill. Current is supplied from the circuit used to light the interior of the ship while the men are at work. Electric drills have been used in the United States government yard at Brooklyn with good results.

Chicago, Ill.—Bear Magneto Electric Company; capital, $3,000,000.

East Aurora, N. Y.—East Aurora Electric Light Company; capital, $12,000.

Saginaw, Mich.—Michigan Traction and Electric Company; capital, $100,000.

Mishawaka, Ind.—Dodge Electric Light and Power Company; capital, $25,000.

Alpena, Mich.—Alpena Electric Light Company; increase of capital stock to $84,000.

Port Angeles, Wash.—The Port Angeles Gas, Water, Electric Light and Power Company; capital, $300,000.

Newark, N. J.—The Newark District Telegraph Company has filed an increase of $75,000 to their capital stock, making a total of $100,000.

Wheaton, Ill.—Wheaton, Du Page County, Electric Light and Water Company; capital, $20,000. Incorporators: Horace H. Fuller, Jordan J. Cole and Charles W. Kimball.

Chicago, Ill.—The International Aluminum Company; capital, $10,000,000; for the manufacture and use of aluminum. Incorporators, Franklin Babcock, William A. Pfaff and Charles H. Wood.

Denver, Col.—The Denver, Lakewood and Golden Electric Railroad Company has filed amended articles of incorporation increasing its capital stock to $600,000 and the number of its directors to seven.

Roanoke, Va.—The Southern Electric Street Car Company; capital, $500,000. Officers, M. A. Riffe, president; R. H. Woodrum, vice-president; R. E. Cole, secretary, and J. W. Coon, treasurer, all of Roanoke.

AMONG THE BUSINESS HOUSES.

The Crocker-Wheeler Motor Company, Fourteenth and Washington streets, New York, have recently enlarged their factory and added considerable new machinery. Among recent orders is one for a triplex automatic electric pump for Mr. E. H. Johnson's palatial country house.

The Thomson-Houston Electric Company, through its Western Isolated Lighting Department, Chicago, reports the following recent sales: St. Louis Railroad Company, 400 light incandescent plant for power house and car barns; and G. F. Culver & Brothers, Salt Lake City, Utah, 100 light incandescent dynamo, to be used in connection with a plant for lighting an office building sold some months ago.

The National Electric Manufacturing Company, Eau Claire, Wis., have published one of the handsomest catalogues of the season. The cover is of a deep black color, with embossed lettering. Each page has a tasty border printed in blue. The illustrations fully show the various component parts of the National transformer system which the catalogue is designed to describe. A number of valuable tables and practical hints occupy the last pages of the book.

The Complete Electrical Construction Company, 22 Cortlandt street, have just finished wiring and installing the electric light plant of the "Vigilancia," the sister ship of the "Segurança," both of which belong to the United States and Brazil Mail Steamship Company. The present installation is on the same general plan as that of the "Segurança," which was fully described in the ELECTRICAL REVIEW, and in addition many new and convenient devices have been included.

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CONTENTS.

	PAGE.
Wages of a Telegraph Operator	199
Vermont Laws	199
The Electric Cane	199
Giles' Arc Lamp	199
Storage Battery Street Cars as a Business Enterprise	199
Visit to a Great Electric Light Station	199
Electro-Magnetic Radiation	200
Electrolytic Administration of Medicine	200
The New Pulitzer Building	200
The Money Market Illustrated	200
The Versatile Repeater	200
Views, News and Interviews	201
Big Judgment Against an Electric Light Contractor	201
Testing the Centrality of Cable Cores	201
Electric Drill for Ship Building	201
New Corporations	201
Among the Business Houses	201
The Subways	202
The Earth an Electric Motor	202
Correspondence:	
Our Washington Letter	203
Our Chicago Letter	203
Our Boston Letter	203
Our St. Louis Letter	203
Westinghouse Electric and Manufacturing Company	203
Financial	203
Telephonic News	204
The Financial End of It	204
The Way of the Lightning	204
A New Battery Connection	204
Interesting Points About Electro-Magnets	204
Our London Letter	205
The Tough Lineman	205
Jacobs' Feed-Water Heater	205
Final Fees in Patent Cases	205
Telegraphic	205
Victoria Telegraph Service Improved	205
The Latest Figures	205
Electric Power	206
An Early Form of Telegraphy	206
Conduit Couplings	206
Fishing with the Electric Light	206
Electric Clubs:	
New York Electric Club	206
Boston Electric Club	206
Personal	207
Mr. Mackay's Property Now	207
To Celebrate the Work of the Inventor	207
The Shipman Engine	207
Electric Light News	207
Call Box Decision	208
Board of Electrical Control	208
Annual Dinner of Edison Men	208
The New Bain Insulator	208
Electrical Supplies and Pies	208
Book Reviews	208
The Street Railroad Pass	208
New Business of the Westinghouse Company	209
Iron Roofs	209
Getting Ready for the Providence Meeting	209
Kindred Interests	210
To Bid Again	210
Electrical Patents	210

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
Ansonia Brass & Copper Co	xxiv
Armington & Sims	xxiv
Bridgeport Brass Co.	xxiv
Brush Electric Co.	xxiii
Davis, Charles H., Electrical Engineer	xxiv
Day's Kerite Insulated Wires	xxiv
Eastern Electric Cable Co.	xxiv
Hampson & Co., E. P.	xxiv
Jewell Belting Co.	xxiv
Moore, Alfred F.	xxiv
National Electric Mfg. Co	ii
Okonite Co.	xxiv
Simplex Electrical Co.	xxiv
Standard Underground Cable Co	xxiv
Tucker Electrical Construction Co	xxiv
Wilmot & Hobbs Manufacturing Co., The	xxiv

INSIDE PAGES.

Alexander, Barney & Chapin	xvi
American Bell Telephone Co	xv
American Circular Loom Co	xiii
American Electrical Works	xiii
Baker & Co.	xvi
Ball Electric Light Co	xv
Barnes Co., W. F. & John	vi
Baxter, H. E. & C	xvii
Bernstein Electric Co	xxv
Bids for Electric Lighting, Gas and Vapor Lights	iv
Bombay Municipality	iv
Brownlee & Co.	vii
Bubier Mfg. Co.	iv
Buckeye Engine Co.	xx
Burton Electric Co.	xvii
"C. & C." Electric Motor Co	vii
Central Electric Co.	xix
Chadbourne, Hazelton & Co	xviii
Clark Electric Co.	xviii
Consolidated Electric Storage Co., The	vi
Crocker-Wheeler Motor Co.	xx
Crosby Electric Co.	xii
Dwight Slate Machine Co.	xvii
Eastern Electrical Supply & Construction Co.	xv
Eastern Plaster Board Co	vi
Edison General Electric Co.	xxi
Edison Manufacturing Co.	v
Electric Construction and Supply Co.	xi
Empire China Works	xiii
Empire City Electric Co.	iii
Eugene F. Phillips Electrical Works, Ltd.	xiii
Faraday Carbon Co.	xvii
Field Engineering Co.	x
Fletcher & Fletcher Electric Co.	xviii
Fort Wayne Electric Co.	xxii
Foundry and Machine Dept. Harrisburgh Car Mfg. Co.	vi
Garvin Machine Co.	vi
Gate City Electric Co.	xix
Goodyear Hard Rubber Co.	ix
Gordon & Co., W. H	xvii
Greeley & Co., The E. S.	x & xvii
Heine Safety Boiler Co.	vi
Heisler Electric Light Co.	x
Hill, Warren S.	x
Holmes, Booth & Haydens	xiv
Holtzer-Cabot Electric Co.	xi
Indurated Fibre Pipe Co.	xiv
Industries	xviii
Independent Bung Co.	xiv
India Rubber Comb Co.	ix
International Aluminum Works	xviii
Lairt & Lee	iv
Lane & Bodley Co.	xvii
Law Telephone Co.	210
Leclanche Battery Co.	iii & xiii
Leffel & Co., James	xvii
Lehigh Valley Creosoting Co.	xiii
Maguire, F. Z.	iv
Marshall, Wm.	xiii
Messner, C. W.	xviii
National Carbon Co.	vii
National Electrical Mfg. Co	xxii
National Pipe Bending Co.	xiv
Newark Machine Tool Works	xiii
New England Butt Co.	x
New York Belting and Packing Co.	xvii
New York Insulated Wire Co.	xiii
Noye Mfg. Co., John T.	vi
Otis Bros. & Co	v
Ostrander & Co., W. R.	xvii
Page Belting Co.	xv
Paillard Non-Magnetic Watch Co	xv
Peirce, H. T.	210
Parker-Russell Mining and Manufacturing Co.	xvii
Perkins Electric Switch Mfg. Co.	vii
Phœnix Glass Co.	xiii
Phosphor-Bronze Smelting Co., Ltd	vi
Pond Engineering Co.	vi
Queen & Co., James W.	xiii
Royce & Marean	xvii
Santley & Co., W. R.	xv
Sawyer-Man Electric Co.	xx
Schieren & Co., Chas. A.	210
Schuyler Electric Co.	xviii
Schoverling, A.	xv
Sessions Foundry Co.	xx
Shaw & Co., J. Elliot	iv
Shultz Belting Co.	vi
Sigourney Tool Co.	xv
Solar Carbon and Mfg. Co.	xx
Southern Electrical Supply Co.	xiv
Standard Electric Supply Co.	xxii
Standard Paint Co.	xiii
Stanley & Hall	vi
Star Electrix Co.	210
Stephenson Co., John	vii
Swift Manufacturing Co., H. E.	xx
Tropical American Telephone Co.	x
Thomson-Houston Electric Co.	viii
United Electric Traction Co.	xix
Universal Arc Lamp Co.	xviii
Vincent & Co., Charles R.	vi
Walker Electric Co	vi
Washburn & Moen Manufacturing Co.	xvii
Watson & Stillman	xiii
Western Electric Co.	xvii
Westinghouse Electric & Mfg. Co	ix
Weston Electrical Instrument Co.	xvi
Whipple Co., Fred H.	xvi
Williams & Potter	vi
Woodhouse & Rawson	xv
Wyckoff, Seamans & Benedict	210

It is stated that Sir J. Pender, president of the Eastern Telegraph Company, will make a trip to the Pacific Coast of British America next Spring; this is part of a project to lay a cable from Vancouver to Australia. The interruption of communication between England and Australia, by reason of an accident to the Eastern Telegraph Company's cable, has created much dissatisfaction and the company think of establishing a second line by way of Canada and the Pacific.

In Paris it is proposed to enforce upon electric light companies soliciting franchises for new work, the condition that they shall employ furnaces which consume their own smoke, or else use only such fuel as does not produce smoke. This rule has not yet been adopted, and is looked upon as an attempt on the part of the enemies of the electric light to impose new and unnecessary restrictions on the development of the industry. Needless to say, the proposal is meeting with vigorous opposition from all the electrical companies.

The project now under consideration by the Pennsylvania Railroad to illuminate a portion of its lines at night by arc lamps is a move in the right direction. Many accidents occur at night which could be avoided if the tracks were properly illuminated. In case accidents still occur after its adoption, the light would be of great service in clearing away wreckage.

Our contemporary, *Electricità*, quotes the following from the *National Scientist*, of London:

"The apparatus consists of a copper sphere 40 centimeters in diameter, enclosed in a zinc sphere 50 centimeters in diameter, the two spheres rotating in opposite directions at a speed of 500 turns per minute. Under these conditions no appreciable electrical phenomena are developed; but on introducing into the space between the two spheres steam at a pressure of six atmospheres, an electric current of prodigious force is developed, increasing in intensity proportionally to the speed of rotation and pressure of steam. The trials just made have created perfect stupefaction in the scientific world."

It would be well for that part of the scientific world which is stupefied to look for the ear-marks of the *fakir* in this great scheme.

The French government is proceeding actively with its policy of connecting various outlying colonies and possessions with the mother country by means of submarine cables. We recently made a note of the sailing of a telegraph steamer to lay cables between Martinique, Dutch Guiana, Cayenne, Brazil and Santiago de Cuba. This system, when completed, will give all the French West Indian possessions telegraphic communication with North and South America, and consequently with Europe. It is also proposed to lay direct cables between Marseilles and Tunis, and Marseilles and Oran, Algeria. A cable between New Caledonia and Sidney is also demanded, and in the Indian Ocean, Reunion, Mauritius and Madagascar are looked upon as being much in need of a system connecting them together and with the outer world.

The President, in his message to Congress, seems to favor, in a slight degree, Mr. Wanamaker's pet scheme of postal teleg raphy. Government control of the telegraph system is not in all countries an unmixed blessing, and we imagine that in this country, while the present system prevails of running every government department in the interests of the friends of the political party in power, it would prove quite the reverse of a blessing. There is little doubt, however, that the public would be glad to see the telegraph rates lowered, and if this can be accomplished, even to a limited extent, by Mr. Wanamaker's plan of making special contracts with the telegraph companies, we see no objection to a trial being made. It seems a clumsy and makeshift scheme on paper, but in practice may be found to work better than appears probable on the face of it.

It is a penny-wise and pound-foolish policy which denies New York city the electric light. The great metropolis cannot afford to be poorly lighted. The streets at night should be as bright as in day. It would be so but for the short-sighted, narrow-minded policy of its city government. How can it be expected to furnish the dazzling radiance of an arc lamp at the price of the feeble and sickly gas jet? It is superlatively ridiculous that a city of over a million and a half of inhabitants should be denied the blessing of good street lighting because a few putty-headed officials think it costs too much. While the small towns and villages throughout the length and breath of the land raise no question on the ground of expense, but eagerly snatch it without discussing its price, the Empire City remains in darkness while its officials cavil over the ninth part of a hair. It is a bad direction in which to economize; there are leaks of other kinds which can be stopped up. We cannot get along without good lighting. This is a large town; the street cars should run both ways and the lights should burn all night, and the best is not too good for us.

THE SUBWAYS.

New York subway matters continue to be in a state of muddle as labyrinthine as the course of the ducts themselves. The electric light companies refuse to pay the rents and the subway company promptly threatens to cut the wires, whereupon an injunction appears on the scene and affairs remain in *statu quo* for a time.

A new company starts up and negotiations are commenced for a division of the subways into two classes, high and low tension, the new company to hold empire over the low tension, the old company to continue in charge of the high. The mayor is happy and a solution of the difficulty appears probable; enter another injunction and once more all is chaos and confusion.

In the history of American electrical work there is no question so discreditable to those nearest concerned as the wire question in New York city. But who are those nearest concerned in this unhappy state of affairs? Not American electrical men, but American politicians. In any other city in the world a scientific question of such moment would have been entrusted to the control and superintendence of practical men of high standing and authority. When the subway board of political hacks, presided over by the mayor, was appointed, the act was received with derision by electrical engineers the country over. The subsequent history of the board has amply justified that reception, and the Board of Electrical Control is now looked upon by all electrical men with utter hopelessness.

Until this body of incompetents is wiped out of official existence and its place filled by engineers and electricians of recognized standing and proper qualifications for the trying task of bringing about peace and order where discord and chaos now reign, there is little hope that the New York subways can be anything but a bone of contention and a source of infinite trouble to all those who are in any way connected with them.

THE EARTH AN ELECTRIC MOTOR.

M. Zingler read before the Academie des Sciences de Paris, a report of an interesting experiment in which the rotation of the earth upon its axis was copied by means of a hollow glass sphere and a Wimshurst electric machine. The glass globe was silvered on the inside and provided with a cavity in which a steel axle was placed. This axle was mounted on a support and the sphere placed between the two discharges of the Wimshurst machine. The balls of the discharges are placed so that a line connecting them will not pass through the center of the sphere. On turning the crank of the electric machine, the sphere is thrown into rotation; if the motion of the crank be regular, the sphere rotates regularly; if the crank motion accelerates, the sphere correspondingly accelerates. The balls of the discharges are placed several centimetres from the surface of the sphere in order to avoid the sparks between the balls. This rotation of a hollow sphere under the influence of two poles of an electric machine is thought by M. Zingler to explain the origin of the planetary movements of our solar system.

The ingenious method of applying drugs hypodermically to the human body which is described in this issue illustrates the marvelous adaptability of electricity. The mysterious agent lends assistance to every art and industry. It gives light, heat and power; transmits intelligence in the twinkling of an eye and adds to our creature comforts in a thousand different ways. The facility with which its efforts may be developed at a distance from its origin; the readiness with which it may be focalized upon a single desired point, however small the space or inaccessible for application of other sources of energy; the slender channel required for its transmission—these are characteristics which mark out for it a great destiny; it will be the ruler of the human world as, indeed, it seems to be of the physical universe. Truly, this is an age of electricity.

CORRESPONDENCE.

OUR WASHINGTON LETTER.

The Estimates for the expenditures of the government for the year commencing July 1st, 1891, which have been submitted to Congress, contain numerous items for electrical appliances and show that the government, in some measure, appreciates the advantages which these devices offer.

The Treasury Department, under the advice of Supt. Powell, starts out on a new plan and asks for $125,000 for wiring public buildings. Heretofore this work has been included in the estimates for furniture and has often been left until all other needs have been supplied, with the natural result of having very little left for wiring. A miscellaneous item of $851,925 also covers payment for some electric lighting, and there is another item of $16,000 for gas and electric light fixtures. Among the estimates for installing lighting plants there are the following: In the Court House and Post Office Building at New York, $52,000; Pittsburgh, $15,000; Louisville, $20,000; Brooklyn, $20,000; Charleston, $5,000; Atlanta, $2,000; and for the same buildings in Springfield, Mass.; Manchester, N. H.; Rochester, N. Y.; Houston, Tex.; Augusta, Ga.; San Antonio, Tex.; Montpelier, Vt.; Binghamton, N. Y.; Carson City, Nev.; Hunsville, Ala.; Wichita, Kan., and Abingdon, Va., an aggregate sum of $25,000 is asked. For operating the plant in the New York building it is estimated that nine men will be required at an annual cost of $9,180. The Department also contemplates installing electric lighting plants in the Marine Hospitals at Key West, Fla., and Portland, Me., and in the Immigration Building at Ellis Island, N. Y.

An Item Not Strictly Electrical, but one which may eventually be absorbed by that industry, is for $350,000 asked for by the Light-House Board for lighting rivers. There are now maintained about 1,600 river lights at $160 per year each, and it is desired to increase this number to 1,900. The board reports that "no appropriation made by Congress accomplishes so much, so promptly and with such satisfaction to its immediate beneficiaries as that for lighting rivers. They have revolutionized steamboat navigation, making it almost as easy and as safe to run by night as by day, while before the system of river lighting was established, it was usual for steamers to stop running and tie up to the banks during the dark nights. Steamboats are not only saved time by these lights, but there is a direct saving of money to both owners and shippers in shortening the time in which trips are made, in reducing rates of freight and insurance, and in reducing the liability of the boats to disaster." The board also reports that the electric lighted buoys in Gedney's Channel, New York harbor, have passed from the experimental state into success, and that their practicability has been thoroughly demonstrated. It is desired to considerably extend the system whenever the necessary appropriation can be had. A plan for using electric plants on lightships is under consideration by the board, and it is probable that several of these vessels will be equipped. New ships, suitable for carrying the necessary machinery, will have to be built.

The Agricultural Department wants an appropriation of $896,703 for the business of the weather bureau which is to be transferred to it from the army signal office. Of this amount $170,000 is for telegraphing weather reports, $15,000 for sea coast telegraph lines and $2,000 for the salary of a superintendent of telegraphs.

The Signal Office will retain charge of the military telegraph system, which embraces about 1,400 miles of line, connecting 40 military stations, and for maintaining and operating these lines $15,000 is needed.

The Commissioner of Public Buildings and Grounds submits an estimate of $18,465, for replacing the entire system of overhead wires belonging to the departmental telegraph lines, with underground cables. He understands it to be the will of Congress that no more overhead wires shall be erected in this city, otherwise he would recommend new pole lines at a cost of $1,600. The government officers, generally, appear to think that their own telegraph poles are very ornamental and those belonging to corporations are very ugly.

The Watervliet Arsenal proposes to have an incandescent lighting plant at a cost of $18,500 with an additional $5,000 for a 150 horse-power engine to drive the dynamos. The commandant supports his request for the appropriation with a statement that the present system of illuminating by gas has been a source of annoyance for many years, and that, inasmuch as the authorities of West Troy have substituted electricity for gas, the supply may be stopped at some future time and the arsenal be left without light. He says "to make this establishment independent as regards lighting, and to supply it with that kind of light which is best adapted for the important work to be done here, on account of its uniformity and facility for changing the position of an incandescent light without difficulty to any place, or concentrate several lamps temporarily at one place, not too much importance can be attached to the request for an appropriation for this purpose."

One Little Sum of $250,000, of which electrical men should get a share, is for the purchase of submarine mines and necessary appliances for operating them. This comes under the army ordnance bureau.

The Soldiers' Home, at Milwaukee, wants to extend its Edison lighting system and is willing to pay $5,000 therefor, if Congress will appropriate the money.

The Artillery School at Fortress Monroe, has an electrical department, for the maintenance of which $807 worth of battery material, etc., is needed, while the cavalry school at Fort Leavenworth confines its electrical ambitions to books and, down at the end of a catalogue containing the "History of the Sioux War," "Fall of Constantinople," "Six Months at the White House," "Life of Jeff. Davis," "Culture of Indigo" and "Rocky Mountain Saints," calls for "Maier's Arc & Glow Lamps" and "*Solomons' Management of Accumulations!*"

The Navy Department estimates for a telegraph and telephone line to connect Port Royal, S. C., with the naval station in that vicinity, $1,000, and for installing an electric lighting plant on the "Lancaster," in addition to the amount heretofore appropriated, $10,000. The bureau of equipment has a a general item of $1,000,000 which includes an allowance for introducing and maintaining electric lights and interior signal communication on board ship.

The Patent Office renews its recommendations for increased salaries to the assistant commissioner, chief clerk and examiners, and urges that provision be made for an additional law clerk. The commissioner states that "the strife among rival litigants for patents brings before the office the ablest lawyers in the country and raises intricate and novel questions of law, and the commissioner and assistant commissioner must necessarily have skilled assistants, possessing legal knowledge and training. The work of the office has so greatly increased that it has become impossible for one person to properly perform the onerous duties pertaining to the position of law clerk."

The Government Hospital for the Insane, near this city, makes requisition for $18,500 to provide incandescent lights for its buildings. The superintendent believes "that the time has come to abandon the old method of lighting by gas, which, with its multiplicity of jets, more or less accessible to the insane, is always to some extent a source of danger, and is also objectionable by its heat in Summer, and by its tendency to smoke, is so at all times, and to substitute therefor the incandescent electric light which is now recognized as the most satisfactory method of lighting buildings of this class."

The Smithsonian Institution wishes to establish an Astro-Physical Observatory in the grounds of the Zoological Park, for which $10,000 will be required, and, to save the average legislator the trouble of inquiring what sort of wild beasts they propose to exhibit in the concern, it is lucidly explained that the purpose is "to determine the relation the sun bears to the earth and to our own daily wants."

For Electric Street Lights in Washington and Georgetown, $46,000 is estimated. This is merely to maintain existing service. The comparative small extent of this service and the opportunity for its growth is shown by the fact that the estimate for gas lights is $138,000 for the same period.

The House of Representatives has caused consternation among the street railroads by passing a bill compelling them to sell eight tickets for 25 cents and to give every passenger a seat. It is not probable that the bill will pass the Senate, but it will give the roads some trouble to defeat it. G. C. M.

Washington, D. C., Dec. 12th.

OUR CHICAGO LETTER.

The Grand Opening of the Wisconsin Central Depot on Harrison street last Monday night was largely attended. The depot is said to be one of the finest in this country, and has certainly the most complete electrical plant of any building of its kind in the world. This feature was one of the most interesting at the opening, and consists of two arc machines of 80 light capacity, and five Edison machines with an aggregate capacity of 4,000 incandescent lights, which are nicely arranged throughout the building. The arc lights are used both inside and out; 11 being used around the entrances and the balance in the train shed. The dynamo room is located in the basement, and is the acme of perfection. McIntosh & Seymour engines, three in number, are used in furnishing power to the dynamos. These have a total capacity of 650 horse-power.

Commencing December 26th, the Chicago Electric Club will give a series of parties, embracing dancing, card playing and lunches.

Rumor has it that there will be a consolidation of electrical interests in Milwaukee, Wis., about January 1st. It is most probable that the railway and lighting companies will be placed under one management. The talked of consolidation, however, will guard against competition.

Mr. Geo. Cutter has made arrangements to handle the rubber goods made by the Revere Rubber Company for electrical purposes. The high class of rubber goods made by this company insures complete insulation wherever used.

Charles G. Armstrong, late assistant manager of the Great Western Electric Supply Company, has resigned and has been engaged by Mr. George Cutter. Mr. Armstrong has devised a number of ingenious devices for electrical work, some of which have been noticed in our columns. A shop will soon be opened for the manufacture of these devices, as well as a number of others owned and controlled by Mr. Cutter.

Since the Changes in the Great Western Electric Supply Company, an inventory has been taken and all dead stock has been closed out. They are now the possessors of one of the best and most thoroughly equipped electrical supply houses in this country. Their aim will be in the future to carry a full and complete line of everything needed in the business. Mr. H. K. Gilman, who is well known to the electrical fraternity throughout the West, has been appointed general manager. Mr. Gilman, until recently, was assistant general manager of the North West Thomson-Houston Electric Company, of St. Paul. George M. Angier, formerly with the Thomson-Houston Company, has been placed in charge of the lighting and railway supplies. E. R. Croleus, who has been with the company since its organization, will remain in charge of the fixture department.

Among the Many Testimonials received by the Electric Merchandise Company on their rawhide pinions is one from the United Electric Railway Company, of Nashville, Tenn., which reads as follows: "We have used your rawhide pinions and are well satisfied with them. While the life of a rawhide pinion is not quite as long as a good bronze pinion, the saving on the iron gear makes them quite economical. I have to-day sent you an order for a dozen."

Personal.—Allan V. Garratt was a recent visitor in the city. D. B. D.

Chicago, December 13th.

OUR BOSTON LETTER.

Mr. P. H. Alexander, of the well known electrical supply house of Alexander, Barney & Chapin, was in this city to-day.

H. E. Duncan, the popular and genial traveling representative of the American Waltham Watch Company, has started on another long business trip in the West. There is a steadily increasing demand for the Waltham magnetic watch among the electrical people, particularly in the West.

The Boston Electric Club held its annual meeting Thursday evening, December 11, and all the gentlemen nominated recently as officers of the Club for 1891 were unanimously elected.

The Winchindon Electric Light and Power Company, of Winchindon, Mass., held its annual meeting Tuesday, December 9, and re-elected its present officers for another year. The treasurer's report made a very satisfactory financial showing of the company's business since its start.

The Society of Arts held a meeting at the Massachusetts Institute of Technology, on Thursday evening, December 11. Mr. E. Devonshire, associate member Institute of Civil Engineers, of London, Eng., read a very interesting paper on "Purification of Water by Metallic Iron," illustrated by experiments.

Mr. H. C. Spaulding, of the Thomson-Houston Electric Company, gave a lecture on "Electric Lighting and Electric Power" before a large and appreciative audience at the Newton, Mass., town hall, Wednesday evening, December 10. Mr. Spaulding acquitted himself so creditably, the Reed Fund Committee, of Newton, requested him to repeat the lecture Saturday evening (to-night), December 13.

The Standard Electric Supply Company has been appointed sole New England agents for the John A. Roebling's Sons Company for the sale of the latter's products, etc. The Standard are handling large quantities of the Star Electrix Company's products, for which the firm is also sole New England agents.

The Jewell Belting Company, Hartford, Conn., has received an order for a 30-inch three-ply belt from the Derby Gas Company, and when the belt is finished it will be placed in the new station of the latter. The Jewell Company has also received a handsome order for the complete belting outfit for the station of the Powellton Electric Light Company, of Philadelphia.

The Billings & Spencer Company, Hartford, Conn., has nearly finished installing its electric light plant. The dynamos are in position, and these comprise an Edison machine of 270 light (16 candle-power) capacity, and a Westinghouse arc (20 light) dynamo. The foundation for the 40 horse-power Ide engine is now ready, and it is expected that the plant will start up on or about January 1. W. I. B.

Boston, December 13th

OUR ST. LOUIS LETTER.

In Tightening a Wire, Albert Junior, a lineman of the Missouri Electric Light and Power Company, came in contact with a live wire. The full current passed through his body, and the man was killed. He had, in violation of the company's rules, neglected to wear rubber gloves, and it was owing to this that the accident occurred. Junior was 23 years old, and had been four years employed as a lineman.

The Mound City Street Railway Line is now running by electricity. It is working very smoothly under the Thomson-Houston system.

Personal.—Mr. B. J. Arnold, of the St. Louis Thomson-Houston office, will shortly remove to Chicago, and will be succeeded by his brother, Ernest Arnold. It would appear as though there will be a general change in all the St. Louis agencies.—Mr. Reese, of the Edison Company, has gone to San Francisco to take charge of their office there, while Mr. Horn takes care of the St. Louis branch.—The Heisler Company have gradually been removing their works to Philadelphia, and now have but a small portion of their business situated here.—Mr. Wilson, of the Western Electrical Supply Company, has left for Centralia, Ill., to see to the plant he is about to erect there.—Mr. C. W. Hazeltine, of the Hazeltine Electric Company, left Saturday for New York. The new carbon protector of this company is meeting with approval from electricians all over the United States, and as soon as their machinery is set up they will put them in the market. At present samples only are being distributed.—Mr. George McKinlock, of the Southern Electrical Supply Company, has resigned the vice-presidency of that company in order to take an extended trip abroad. He sailed Saturday on the "Etruria," will visit England, Ireland and the Continent, and, in fact, will take a trip around the world. He will be absent a year. With Mr. George McKinlock's departure, a new Richmond enters upon the electrical field in the person of a baby boy, the son of Mr. Walter C. McKinlock.

The Union Electrical Construction Company report a good business for the past two weeks. They are at present placing a plant in the Artifical Ice Department of the Guesidick Brewing Company.

The Construction Work for the Liggett & Meyer Tobacco Company's works is being done by the Southwestern Engineering Company.

The Unicycle Elevated Electric Company have recently purchased three motors for their system at Fort Worth, Texas.

Electric Lines were started in Carthage and Joplin, Mo. In both lines St. Louis capital is placed. W. H. B.

St. Louis, December 12th.

Westinghouse Electric and Manufacturing Company.

Readers of the ELECTRICAL REVIEW, who have closely followed the news in our electric light and power columns, need not be reminded of the immense business done by the above-named company. In order to carry on the rapidly extending business of the company in a satisfactory manner, the board of directors last week decided to issue $3,060,000 six per cent. preferred stock, par $50. A recent estimate of the company's assets is $6,280,000, and the liabilities are placed at $3,642,045.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, December 13, 1890. New York, Boston and Washington Stock Exchanges. Pittsburgh closing December 12, 1890.

NEW YORK.	
Western Union Telegraph Co.	75¾.
American Telegraph & Cable	82.
Central and South American	150.
Mexican	210.
Commercial Cable Co.	101.
Postal Telegraph Cable	90.
Edison General Electric Co.	87.
" " Deferred	
Consolidated Electric Light	
Edison Electric Illuminating Co.	70.
United States Electric Light	90.
North American Phonograph	30.
BOSTON.	
Thomson-Houston Electric Co.	39¼.
" " " Preferred	85½.
" " " Series C	
" " " Series D	5¾.
" " International Co	
" Welding Co.	
" European Welding Co.	
Ft. Wayne Electric Co	10¼.
TELEPHONE:	
American Bell	216.
Erie	46.
New England	49.
Mexican	.70
Tropical American	
MISCELLANEOUS:	
Edison Phonograph Doll	
WASHINGTON.	
Pennsylvania Telephone	85.
Chesapeake and Potomac	68.
American Graphophone	10¾.
United States Electric Light (Washington)	
Eckington and Soldiers' Home Electric Ry	53.
Georgetown and Tennallytown	46.
PITTSBURGH.	
Westinghouse Electric Mfg. Co.	129¼.

Telephonic News

*** The American Bell Telephone Company has declared the usual quarterly dividend of $3 per share, payable January 15, to stockholders of record, December 31.

*** At Paris, the apparatus in connection with the Paris London telephone, will be provisionally installed at the Bourse. The telephone will be available night and day, and also on Sundays.

*** The Hudson River Telephone Company has nearly finished putting up a long distance line from Albany to Schenectady and Amsterdam. A line will also be run from Schenectady to Saratoga.

*** The Cedar Rapids, Mich., telephone exchange now has 305 subscribers, a net increase in the past ten months of 42. If the increase continues as at present, it will necessitate the erection of new cables in the Spring, and an addition to the switchboard.

The Financial End of It.

The board of directors of the Edison Electric Illuminating Company, of New York, have declared a quarterly dividend of one per cent., payable January 15, 1891. In addition, the directors have declared an extra dividend of five per cent. on the capital stock, representing surplus earnings, payable in certificates convertible into stock at par whenever the company shall increase its capital beyond the present authorized amount, or redeemable in cash, at par, at the option of the company. Until so converted or redeemed these certificates will bear interest at the same rate, and payable at the same time, and in the same manner, as dividends may be paid on the company's capital hereafter. These dividends will accrue to stockholders of record January 2. Convertible certificates will be delivered on and after February 2.

The directors of the Western Union Telegraph Company at their regular quarterly meeting on December 10, declared the usual dividend of 1¼ per cent. payable on January 15, to stockholders of record on December 20. The statement submitted by President Green showed that, while the estimated net earnings for the quarter ended September 30, were $2,000,000, the actual revenue was $2,000,731. The approximate statement for the current quarter, based upon partially completed returns for the past and estimates for the balance of this month compares as follows with the actual returns for the corresponding quarter last year. Net revenues, $2,000,000, surplus October 1, $10,733,832, an increase of $1,425,624; total, $12,733,832, an increase of $1,425,624; interest and sinking fund, $242,483, an increase of $8,633; balance, $12,491,349, an increase of $1,416,691; dividends, $1,077,399, a decrease of $646,451; surplus, $11,431,950, an increase $2,081,413.

The decrease in the amount of dividends paid is due to the fact that for the quarter ended December 31, 1889, an extra dividend of ¾ was declared, amounting to $646,432.

The Eastern Electric Cable Company, Boston, has declared its regular semi-annual dividend of three per cent. on its preferred stock, payable December 16.

In an interview regarding the existing financial stringency, Mr. Chauncey M. Depew said the business enterprises of this steam and electric age of manufactured values and commercial exchanges made the currency of the country utterly incapable of meeting the demands of legitimate trade. Not only do the people lock it up, but the government also does it in time of a general scare by buying bonds. At present the importer and the wholesale dealer are so apprehensive about the ultimate results of the McKinley bill that they are keeping their money actually out of circulation because of the payment of these dues next February.

The Way of the Lightning.

The following are a few facts that belong to every thunder-cloud: The lower surface, the surface next to the earth, is exceedingly uneven, and generally charged with positive electricity. Some parts of the cloud are much nearer the earth than others. Electricity gathers in the largest measure at the lowest point, or is said to have at its lowest point the highest electrical tension. A highly-electrified water-cloud at the time of a powerful shower seldom exceeds in height a quarter of a mile (1,320 feet). When the electrical tension is sufficiently high, the electricity passes across the intervening atmosphere to the highest point, usually negative, but opposite to that of the cloud, on the earth, directly under the cloud. This passage is called a thunderbolt. During an electrical storm, if the air be very dry, then the lightnings are more zig-zag and the thunders more deafening. If the lowest electrified cloud be directly over a short object in the immediate vicinity of a tall one, the short object—it matters but little of what kind—will be "struck." This fact, that the way of lightning from a cloud to some object on the earth beneath is usually as direct as possible, will greatly help to a better understanding of some of the mysteries of lightning. So that it is not always the highest object in the region of a prevailing thunder-shower that is struck, but that object which is directly under the lowest hanging cloud. It not unfrequently happens that a corner of a dwelling house is struck sooner than a tall chimney of the same, because the corner thereof was directly under the lowest part of the electrified cloud. Repeated and close observation will verify the truth of these sayings.

Interesting Points About Electro-Magnets.

In a recent Cantor lecture, Prof. Sylvanus P. Thompson discussed some very interesting features of the electro-magnet, presenting data not generally known, of which the following is an abstract:

Round cores are better than square ones for electro-magnets, inasmuch as there is less leakage from core to core by reason of the smaller amount of surface; besides, there are no edges or corners to permit leakage, and the quantity of wire to induce a given number of lines of force will be less because the circle has a smaller periphery than a square. To make a magnet work rapidly the coils should not be distributed all along the core, but heaped up near the poles. Hughes made a number of researches and found out the best length and thickness of pole-pieces for what is known as the Hughes magnet, namely, a permanent steel magnet, generally a compound one, having soft iron pole-pieces, and a couple of coils on the pole-pieces only. He found that it was an advantage not to use too thin pole-pieces, as in that case the magnetism in a permanent magnet did not pass through the iron without considerable reluctance, and not to use too thick pieces as too much surface promoted considerable leakage from one to the other. The proportion eventually adopted was about six times the diameter, or rather longer. In further researches he used a magnet of shorter form and with an armature but three millimetres thick, one centimetre wide and five centimetres long, the poles turned over at the top towards one another. He tried various forms of armature and found it decidedly an advantage to shorten the length of the armature so that it did not protrude far over the poles.

Du Moncel made some interesting researches upon the effect of polar projections or shoes. He made a magnet with a core of round iron four centimetres in diameter, the parallel limbs of which were ten centimetres long and six centimetres apart. Two flat pieces of iron slotted at one end so as to be adjustable toward or from each other were mounted on the poles. Exciting this electro-magnet with a certain battery it was found that the attraction was greatest when the poles were pushed apart about one-fourth of the interpolar distance. At two millimetres apart the attraction was 900 grammes; at 10, 1,012 grammes; at 15, 25, 40 and 60 the attraction was 1,025, 965, 890, 550 respectively. With a stronger battery the magnet without shoes had an attraction of 885 grammes, but with the shoes 15 millimetres apart 1,195 grammes. When only one pole was employed the attraction which was 88 grammes without a shoe *was diminished* by adding a shoe to 39 grammes. These results would not be applicable to permanent magnets of steel, for the reason that putting an armature on an electro-magnet makes the magnetic circuit better, throwing more magnetic lines not only through the armature but also through the whole of the iron, inasmuch as you have a circuit of less reluctance with the same external magnetizing power in the coils acting around it. The presence of an armature in some experiments referred to in a prior lecture, multiplied the total magnetic flow tenfold for weak currents and nearly threefold for strong currents. With a permanent steel magnet, however, a number of lines of force are a fixed quantity and however much you diminish the reluctance of the magnetic circuit you do not evoke any more lines; when the armature is away the magnetic lines arch across not only at the ends but from its flanks, the whole of the magnetic lines leaking somehow across the space; when the armature is on, instead of arching out into space as free as they did, they pass for the most part through the armature. Although the lines in this case mostly take one path, not a single line has been added at the bend of the magnet, the total number of lines is absolutely the same. In other words, by putting an armature upon a steel horse shoe magnet you simply *collect* the magnetic lines, you do not *multiply* them.

A popular superstition with regard to magnets is that you must gently remove the armature for fear of weakening the permanent magnetism. The fact of the matter is that the converse of this is the real truth. The armature should be applied gently, but it may be pulled off as suddenly as you like; it does the magnet good rather than harm. It has often been proposed to increase the power of electro-magnets by interposing iron between the several layers of windings. Several such constructions, known as Camacho's, Cances's and Varley's have been patented. They are founded on fallacy, as the iron is far better placed either right inside the coils or right outside them, so that they properly constitute a part of the magnetic circuit. Another delusion is to suppose that forming the coils of iron wire is advantageous. The iron is so poor a conductor that an expenditure of six times as many watts must be made to produce equal magnetizing power to the copper coil.

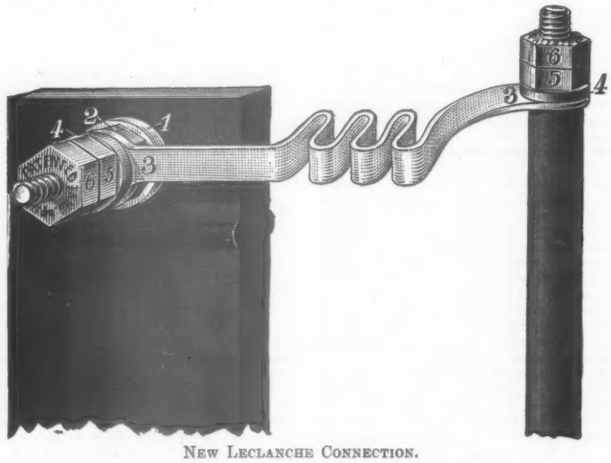
A magnet always tends to diminish the length of its magnetic circuit. Armatures are drawn in as near as can be to close up the magnetic circuit. A curious property of the hollow core is its effort to project an iron wire or nail inserted within it while magnetized. The magnetic circuit tries to complete itself by means of the loose piece of iron or nail and therefore pushes it out so as to afford more surface for leakage. This projectile power is quite considerable, the device forming a sort of electro-magnetic pop-gun.

In designing electro-magnets for use in alternating currents the core should be carefully laminated. The rapid reversals of magnetism excited by alternating currents set up eddy-currents in every piece of undivided metal within range. All frames, bobbin tubes, bobbin ends, must be carefully slit or they will overheat. If a domestic flat-iron is placed on the top of the poles of a properly laminated magnet in an alternating circuit, the flat-iron is speedily heated up by the eddy currents generated within it. A copper disk or ring placed over the pole of such an electro-magnet is violently repelled, as developed in a series of beautiful and elaborate researches, by Prof. Elihu Thomson. The explanation of this phenomenon is that there is a lag in phase between the current induced in the copper ring by the magnet and alternating current, which creates a repulsive instead of an attractive effort.

The rapid action of electro-magnets is dependent, not so much upon their degree of magnetization, as upon electric inertia. The current in the circuit cannot suddenly rise to its full value. Ohm's law does not literally apply until the current reaches its full strength. Helmholtz establishes a formula for the value of the current at any short time, t after it is turned on. The formula is:

$$i_t = \frac{E}{R}\left(1 - e^{-\frac{R}{L}t}\right)$$

Where i_t means the strength of the current after a lapse of a short time t, E is the electro-motive force, R the resistance of the whole circuit, L the co-efficient of self-induction, and e the number 2.7183. If we assume any given case, as, for example, where E is 10 volts, R is one ohm, and L, the self-induction, is 10 quadrants, then we will have the following current strengths in amperes at the end of 1, 2, 5, 10, 20, 30, 60 and 120 seconds, respectively: .95, 1.81, 3.936, 6.343, 8.646, 9.591, 9.975, 9.999. According to Ohm's law, that is, with a steady current, the value would be 10 amperes; but Helmholtz's law shows us that with the great self-induction which we have assumed to be present, the current at the end of 30 seconds has only risen up within 95 per cent. of its final value, and only at the end of two minutes has practically attained full strength. It will be noted that the time constant of the circuit can be reduced by either diminishing the self induction or increasing the resistance. In electro-magnets the self-induction may be diminished by connecting the spools in multiple arc, because half of the line current will go through each coil, hence the time constant of the circuit, when the coils are in parallel, will be a quarter of that which it will be when they are in series. On the other hand, the final magnetizing power of the two coils in parallel is only half what it would be with the coil in series. The general explanation attributing this result to extra currents being induced in such directions as to help one another when the coils are in series and neutralize one another when they



New Leclanche Connection.

A New Battery Connection.

The Leclanche Battery Company, 149 West Eighteenth street, New York, have just put upon the market the battery connection illustrated herewith. The makers claim that when it is used there will be no corrosion, no local action, and no development of resistance in the cell. These are common battery faults and a device which can correct them will at once prove of great value. Referring to the cut (1) is a washer made of a non-oxidizable composition which cannot be corroded with battery salts. A similar washer is placed on the opposite side of the carbon. Through these two washers and the carbon runs a zinc screw. A zinc nut (2) is placed on the screw and turned up tight against the washer (1) to bind the whole tightly to the carbon. A flexible metallic connecting strip (3) not subject to oxidation or corrosion is placed upon the zinc screw to connect the carbon pole of one with the zinc of another. Another zinc washer (4) prevents the strip (3) from being twisted when the nut (5) is screwed up. The zinc nut (5) screws up tight against the washer (4) to bind the connection and a check nut of zinc (6) is used to reinforce the nut (5).

The screws on both the carbon and zinc are of the same size and thread, and the nuts of both are alike and interchangeable. No local action is possible between the carbon and the zinc screw because they do not touch, the electrical contact being made through the non-oxidizable washers. All cells sold by the Leclanche Battery Company will be furnished with this connection, and future purchasers will thus be saved the necessity of providing wires for connecting the cells.

are in parallel, is fallacious, because whichever way the current flows to make the magnetism it is opposed in the coils while the current is rising and assisted in the coils while the current is falling by the so-called extra currents. If the current is rising in both the coils at the same moment, then, whether the coils are in series or in parallel, the effect of self-induction is to retard the rise of the current.

The same theory of grouping will apply to battery cells. The amateur's rule to arrange the battery so that its internal resistance is equal to the external resistance is wholly wrong for rapid working. Suppose the line and electro-magnet together have a resistance of six ohms, and that we have 24 Daniell's cells each giving one volt and having an internal resistance of four ohms, and that the co-efficient of self-induction of the electro-magnet and circuit is six quadrants. With all the cells in series, the resistance of the battery will be 96 ohms, of the whole circuit 102 ohms, and the full value of the current .235 of an ampere. When all the cells are in parallel, the resistance of the battery will be .133 of an ohm, total resistance 6.133 of an ohm, and the full value of the current .162 of an ampere. According to the amateur rule the cells should be arranged in four parallels, each containing six cells in series, which will make the internal resistance of the battery six ohms, total resistance of the circuit 12 ohms, full value of the current .5 of an ampere. Now the corresponding time constants in the three cases just noted will be in series .06 of a second; in parallel .96 of a second; grouped for maximum steady current .5 of a second. It will thus be seen that when rapid working is required, far better action is secured with cells in series than in any other mode of grouping.

OUR LONDON LETTER.

Second Annual Dinner of the Institution of Electrical Engineers.—The second annual dinner was held on November 20, at the Criterion Restaurant, Dr. John Hopkinson, F. R. S., being in the chair. Among those present were the postmaster general, the Right Hon. H. C. Raikes, M. P.; the attorney-general, Sir R. G. Webster, Q. C., M. P.; the Astronomer Royal, Mr. W. H. M. Christie, F. R. S.; Mr. G. B. Berkley, vice-president of the Institution of Civil Engineers; Sir George Gabriel Stokes, M. P., president Royal Society; Mr. J. Tomlinson, Jr., president Institution Mechanical Engineers; Sir R. Rawlinson, K. C. B., vice-president Institution of Civil Engineers; Professor Dr. Coleman Sellars, member of the International Niagara Committee; Sir Stephenson A. Blackwood, K. C. B., secretary, general post office; Sir H. Trueman Wood, secretary Society of Arts; Mr. R. E. Crompton, Mr. Gisbert Kapp, Professor George Forbes, F. R. S.; Professor W. E. Ayerton, F. R. S., vice-president; Mr. Alexander Siemens, Mr. F. H. Webb, secretary of the Institution of Electrical Engineers, and altogether about 200 of the most representative men of the day. Mr. Raikes, who replied for Her Majesty's Ministers, expressed his diffidence in addressing himself to a task which had previously been performed by the head of the present government, the Marquis of Salisbury, "who is a somewhat expert electrician," and when there was another electrical expert near him in the attorney-general. Referring to the growth of telegraphic business, while the number of telegrams sent in 1871 was 10,000,000, in 1889 it was 62,500,000. He said he recalled with feelings of pride that the post office had given to the Institution of Electrical Engineers three of its presidents, Mr. Scudamore, Mr. Preece and Mr. Graves. He went on to refer to the relations of electricity to the various branches of the public service, the Board of Trade, the Admiralty and others, and said the opening of the City and South London Subterranean Railway had given us all an opportunity of testing the use of electricity as a motive power. He finished with the following lines of congratulatory praise:

It is impossible to forecast the enormous future before this particular branch of science. You seem to have taken to yourselves the attributes of the whole of that Pantheon, the whole of those influences which in ancient days were supposed to dominate our sublunary life. But if I had to single out among those mythological deities any one which might seem more appropriately to be the patron or patroness of your science, I would say that you seem to me to have borrowed in a special degree the attributes of that goddess who, we remember—probably those of us who still retain the rudimentary features of our school training—adopted a threefold name and a threefold aspect. If you will permit me, I will conclude with those two lines with which our Latin grammar has made us familiar:

"Terret, lustrat, agit Proserpina, Luna, Diana,
Ima, suprema, feras, sceptro, fulgore, sagittâ."

As I was coming down here I thought I might venture to string together this little paraphrase of those lines:

"Our threefold goddess, with her magic spells,
By turns alarms, enlightens and impels,
While hangs the pale exchange upon her strings,
Her lamp cheers cities, and her touch gives wings."

Dr. Coleman Sellars was one of the responders to the toast of "Our Guests," and said he was glad to have an opportunity of meeting face to face men whom he had before known only by name. For himself it was more than 200 years since his people had arrived in America, and yet there was not one drop of blood in his body that was not English. They were brothers, and, as brothers, they must work in this great invention. He referred, at some length, to the project of utilizing the waters of Niagara.

Mr. Raikes, in proposing "The Institution of Electrical Engineers," pointed out that the Institution of Electrical Engineers, then called the "Society of Telegraph Engineers," was founded in 1871. The total number of members of all classes in 1872 was 268. In the present year it was 1,738, an increase of 1,470. In 1872 there were only two "students" in the list, whereas now there were 102. Referring to matters in which electrical engineering concerned our daily life, he recalled the system of block signals on railways, and the great advantage of synchronizing time in the most distant parts of the kingdom, and thus securing one cardinal time. This was of enormous benefit in regulating all sorts of matters connected with daily life and ordinary commerce. It was to the electrical engineers that they owed their system of 120,000 miles of submarine cables, and within the limits of these islands 2,000,000 miles of telegraphic system. That did not, he believed, include the telephonic systems, but on this burning question he would say as little as he could; with the expiry of the telephone patents in the course of the next year or two, a fresh field would be opened for the inventive genius of electrical engineers.

Overhead Wires.—A bill for the regulation and control and, if necessary, the removal of overhead wires is shortly to be brought forward by the London County Council.

The City and South London Railway.—To educate and thoroughly accustom the staff in the workings of the plant and lifts, a number of trains have been daily running on this line. In a few days it is expected the Board of Trade will make their final inspection and then the line will be opened to the public. Last Monday, His Serene Highness Prince Hermann of Saxe-Weimar, privately visited the railway, journeyed in a special train to Stockwell, and en route inspected the various stations and plant. Dr. Mather and Dr. E. Hopkinson explained the workings, and on the return journey the Prince traveled on the electrical locomotive and at the finish expressed himself highly pleased and gratified with all he had seen. The company are now promoting a bill for power to extend their line from the King William street terminus to the Angel at Islington.

Birmingham.—The Board of Trade have been applied to by two public companies, the Birmingham House to House Electricity Company and the Birmingham Electric Supply Company, for provisional orders to enable them to supply electricity for public and private purposes in the city.

Telephone Appointment.—Mr. A. R. Bennett, lately connected with the National Telephone Company, has accepted a three years' engagement as manager and chief engineer with the Mutual Telephone Company. His headquarters will be in London, and he has reserved to himself the right to practice also as a consulting engineer and electrician.

New Cable.—The work of laying down the new cable of the Great Northern Telegraph Company, between Newcastle and Gothenburg, which was begun on the 16th inst., was successfully completed on the 22d inst., and was at once opened for correspondence. The cable was manufactured by the Telegraph Construction and Maintenance Company, and laid by that company's vessel, the "Seine."

Paris.—The apparatus in connection with the Paris-London Telephone is to be provisionally installed at the Bourse, and will be available night and day, Sundays included. M. Fontaine calculates that in 1891 or 1892 there will be required for the electric lighting in Paris motive power equal in round numbers to 32,000 horse-power.

CHARLES FFRENCH.

London, Eng., Nov. 28.

The Tough Lineman.

The crowd appalled, in mute suspense,
Gazed at the lineman, who, suspended,
Hung o'er the multitude so dense—
All fancied that his race was ended—
But when they took him down
These words the victim softly said,
"I s'pose it's dark all over town,
But I can't help it!" "Aren't you dead?"
They cried amazed—"Praised be the gods!"
"Oh, no," said he, "I'm pretty tough;
They don't make volts and ohms enough
To kill me—I've sold lightning rods!"

—*N. Y. Herald.*

The Postal Telegraph Company has been granted rights of way in Jackson, Mich. and Jeffersonville, Ind.

Jacobs' Feed-Water Heater.

Charles Jacobs & Company, 45 Oliver street, Boston, have put upon the market the feed-water heater shown in the accompanying illustrations. The makers claim for it great efficiency, simplicity of construction and low cost.

The shell is cast iron, and seamless drawn brass tubes expanded into tube-plates at top and bottom are used. The water chamber at the base has a partition through the middle, which causes the feed-water upon entering the heater to pass upwards through the tubes on one side, and then downwards through the tubes on the other side to the outlet.

The exhaust chamber or shell, whose area is five times that of exhaust pipe, has a partition extending upwards a portion of its

FIG. 1.—JACOBS' FEED-WATER HEATER.

height, which causes the exhaust steam upon entering the heater to rise upwards and around the tubes on one side of partition, then downwards and around the tubes on the other side, to outlet; thus heating the feed-water to from 200° to 212° without back pressure on the engine.

The drip opening at bottom of the exhaust chamber provides for the draining off of condensation, while the blow-off in both sections of the base, allows for complete removal of all sediment.

Should it at any time be deemed advisable to clean the tubes, it can be easily accomplished by loosening the bolts of outer shell

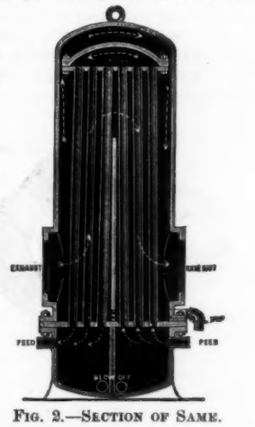


FIG. 2.—SECTION OF SAME.

and raising it by means of eye-bolt at the top, thus exposing the outside of tubes, then by removing the upper cap of water chamber, the inside of tubes can be reached.

Final Fees in Patent Cases.

The Attorney-General, on the request of the Commissioner of Patents, has rendered an opinion of special interest to inventors and patent attorneys. The effect will be to do away with the practice of postponing indefinitely the issuance of letters patent by neglecting to pay the final fees within the required six months, and then, before the expiration of two years allowed by law, applying to have the application renewed. This programme in some cases has been repeated for many years, thus materially extending the life of the patent beyond the 17 years specified in the statutes. The Attorney-General holds that a patent cannot be allowed on any application for renewal not filed within two years after the allowance of the original application.

TELEGRAPHIC

.... The Postal Telegraph Cable Company at Cleveland, O., now have their through wires (52 in number) all underground and working satisfactorily.

.... Telegraphic communication between Germany and Italy is to be improved by the construction of a third line between the two capitals. The line will pass through Bavaria and the Tyrol, instead of through Switzerland, as the existing lines do. Its length will be 1,210 miles, and it will consist of 3 mm. bronze wire. According to the *Elektrotechnische Zeitschrift*, this is the first line from Germany to any foreign country in which bronze wire has been employed.

.... Senator Cullom is reported to have said that at the first opportunity he would ask the Senate to consider the bill agreed to at the last session, placing the telegraph companies under the jurisdiction of the Inter-State Commerce Commission. The bill is drawn somewhat on the line of the Inter-State Act passed in 1888. It declares discriminations, greater charges for longer than shorter distances, rebates, drawbacks, etc., to be unlawful. The telegraph companies are allowed under the bill to do business for the United States and for State and municipal corporations, and for the press, at lower rates than are charged for social and business messages, but provides that no discrimination shall be made between publishers of newspapers. The bill is an important one and Senator Cullom thinks it will pass the Senate at the present session.

Victoria Telegraph Service Improved.

J. Wilson, superintendent of the Canadian Pacific Railway, states that in the future there will be no fear of a break in telegraph communication with Victoria, B. C. The company is arranging for the purchase and submergence as early as possible in the Spring of a three-wire cable in the Gulf of Georgia. The cable now submerged there will be taken up and laid between Port Crescent, Wash., and Port Beecher, B. C., it having been found that these places offer the best landings on the straits. The cable between Victoria and Dungeness will also be kept in repair. This will furnish three distinct lines of communication between Victoria and the main land, and with the improved Pacific postal system from Seattle northwest to Port Townsend, and along the shore of the straits to Port Crescent, will, no doubt, meet all demands. Mr. Wilson also states that in the course of another week the Canadian Pacific Railway will have a fourth wire in operation between Donald, B. C., and Winnepeg, Man., which, with the quadruples working from the former point to Vancouver, will place the company in a much better position than heretofore to handle their constantly increasing business.

The Latest Figures.

Whipple's Reports for December publishes the following information:

CENTRAL ELECTRIC LIGHT STATIONS.

Stations in United States	1,513
" Canada	107
" Cuba	1
" Mexico	9
Total Stations	1,630

GAS COMPANIES.

Companies in United States	968
" Canada	49
" Mexico	1
Total	1,018
Companies operating Electric Lights, U. S.	278
" " " " Canada	20
" " " " Mexico	1
Total	299

STREET RAILWAY COMPANIES.

Companies in United States	886
" Canada	24
Total	910
Electric Roads in Operation and under Contract in United States	248
Electric Roads in Operation and under Contract in Canada	6
Total	254
Cable Roads in the United States	44

* * The Columbus Iron Works Company, Columbus, Ga., is installing an electric welding plant.

* * The construction of the East St. Louis, Venice and Madison Electric Street Railroad has been commenced and ties are now being laid.

* * Newton, Kan., again has light and motion. The electric lights and the street car line are in operation. The bank failures had stopped both.

* * The Piedmont, Ala., Electric Light and Power Company have decided to run the dynamos of the station during the day for the purpose of supplying power to manufactories.

* * The Laredo, Tex., electric street car line has been in operation nearly a year, and it is said that the daily average mileage of the cars running over it exceeds that of any electric road in the United States.

* * San Francisco, Chicago, Buffalo, Boston, and hundreds of little places like Brockton, Mass., have railway companies whose sole motor is electricity. And where is Philadelphia?—*Philadelphia North American.*

* * At a recent meeting of the directors of the Lancaster, Pa., Electric Railway Company, it was resolved to issue free tickets over their electric railway service to the letter carriers in uniform and newspaper reporters of that city.

* * The Edison Concentrating Works, at Humboldt, Mich., burned one night last week. Loss about $10,000, principally on machinery. It was at these works that the Edison electric process of separating the jasper from iron ore was first made a commercial success.

* * The citizens of Germantown, Pa., are bitterly opposed to the overhead electric wires. They have published a protest against the proposed ordinance granting privileges to two street railway companies to erect poles and use the overhead electric wire system of propulsion. Can it be that Philadelphia's influence extends as far as Germantown?

* * The Tacoma and Steilacoom, Wash., Street Railway has been graded to Chamber's Creek. There are 250 men and 60 teams employed and two miles of the track have been completed. The Thomson-Houston electric men are not far behind the track layers. The cars will be running to Chamber's Creek, 10 miles distant from Tacoma, in a few days.

* * The street railway company will begin running cars from Minneapolis to St. Paul within a few days. It is proposed to run the cars at the rate of 25 miles an hour. This cannot be done, however, until the motors specially designed for this line arrive. Until they do, those now being run on the line to Grotto street will be used. They will be put through at the rate of 15 miles an hour.

* * The outlook for the proposed electric railroad connecting the towns of Spencer and Leicester with Worcester, Mass., is now more hopeful since the selectmen of the two former places have given the problem of transportation by electricity a practical investigation. They have recently inspected the systems of Boston and Attleboro. The largest part of the stock has been subscribed by the citizens of Worcester, Spencer and Leicester.

* * In the Providence, R. I., common council, after postponement of more than a month, the ordinance permitting the Union Railroad Company to equip two of the street car lines with the single trolley overhead system of electric propulsion, came to a vote last week. There had been considerable opposition in the hearings, and both opponents and proponents have sent in petitions representing several millions each of taxable property. After considerable discussion the ordinance was defeated, 28 to 13.

* * Hon. John E. Craig, of Keokuk, Iowa, speaking of street railways, gave some points of interest. He was instrumental in building a mile and one-half of electric railway in Keokuk, the population of which is 16,000. The franchise and old horse car line on which people would not ride, cost the company $22,000. The first day the company put on electric cars they carried 5,000 people. The receipts for the first 16 days were $1,050. During the past two months, not including the 16 days above, the company's net earnings, after deducting all expenses of running and interest on bonds, were $2,260. A year's showing like this would be $8,500 per mile net earnings.

An Early Form of Telegraphy.

Among the early devices for conveying information to a distance by means of signals, the following is very ingenious: It was used by a Grecian general, Æneas, who flourished in the time of Aristotle. It consisted of two exactly similar earthen vessels filled with water, each provided with a cock that would discharge an equal quantity of water in a given time, so that the whole or any part of the contents would escape in precisely the same period from both vessels. On the surface of each floated a piece of cork supporting an upright, marked off into divisions, each division having a certain sentence inscribed upon it. One of the vessels was placed on each station, and when either party desired to communicate with the other he lighted a torch which he held aloft until the other did the same, as a sign that he was all attention. On the sender of the message lowering or extinguishing the torch, each party immediately opened the cock of his vessel, and so left it until the sender relighted his torch, when it was at once closed. The receiver then read the sentence on the division of the upright that was level with the mouth of the vessel, and which, if everything had been executed with exactness, corresponded with that of the sender, and so conveyed the desired message.—*Popular Science Monthly.*

Conduit Couplings.

The Interior Conduit and Insulation Company, the sole manufacturers of interior conduits, are continually striving to simplify the methods of construction of their system and to cheapen the cost of their goods. One of the most striking examples of their energies in this direction is to be found in their new coupling or joint, which we illustrate herewith.

The greatest amount of labor expended in the installation of the system is the most vital point of the whole, that is, upon the joint or coupling.

The methods heretofore employed for making joints have been found satisfactory, but in order to insure perfect work, great care had to be exercised on the part of the workman, and it is with the idea of remedying this that the new coupling has been designed and placed upon the market.

The new joint will supplant and entirely dispense with the use of the threading tool, thread, coupling and connecting compound. The sleeve is made of soft, galvanized iron, and being of a slightly larger diameter than the tube itself, fits snugly

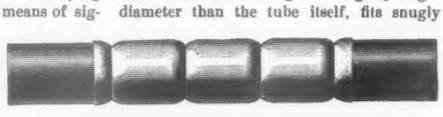


FIG. 1.—NEW CONDUIT COUPLING.

upon it. The tool, which is made in the form of a pair of pliers, serves to press the two slight corrugations upon the outside of both halves of the sleeve and into the body of tube, but does not in the least injure the latter or alter its internal diameter at that point. Joints so made are impervious to moisture and have great strength. By the new method joints may be made upon the floor or bench, and the lengths of the tubing lifted with safety to the wall or ceiling without fear of straining or opening the joints. It is confidently believed that the new tool is destined to become an important factor of every wireman's kit of tools.

Fishing with the Electric Light.

A reporter, whom chance took to the water front, was treated in the course of his rambles among the hole-flecked wharves to a novel sight, says the San Francisco *Chronicle.* At the foot of Beale street he saw some 20 men, women and boys sitting about a square mass of piling bordering an open surface of water, which was brilliantly lighted by a neighboring electric light, fishing. They rapidly pulled up their nets—for

FIG. 2.—TOOL FOR NEW CONDUIT COUPLING.

hooks were not used—each filled with from six to a dozen fish. Fish could be seen leaping frequently from the water. During the daytime the place is deserted by fish. At night, when the adjacent electric light is lit, the brightness attracts the finny wanderers. They gather in such numbers that to catch them with baited hooks would be tiresome. For this reason the crowds that gather there nightly fashion nets out of hoops and draw the strings close together. No bait is used, and the fish entangle themselves in the net by the dozen. A few nights ago one man caught 200 pounds of fish, mostly rock cod and sardines of unusual size.

It is reported that the Metropolitan Street Railway Company, of Washington, D. C., will expend $500,000 in equipping its lines with storage battery cars.

The earnings of the West End Railway Company, of Boston, increased over $45,000 in November. The present average increase per day is over $1,000.

A notable example of immediate and exceptional popularity in literature is to be found in Mr. Eugene Field's two dainty books "A Little Book of Western Verse," and "A Little Book of Profitable Tales," recently issued by the Scribners, which have in two months' time reached their fifth edition. Col. Church's "Life of Ericsson," and Mr. B. E. Martin's "In the Footsteps of Charles Lamb," issued by the same firm, went into their second edition almost immediately upon publication.

The new dam of the Hartford Electric Light Company, crossing the Farmington River at Tariffville, Conn., is now finished. The buildings on the river bank for generating the power for transmission, however, are still in course of erection.

ELECTRIC CLUBS.

New York Electric Club.

Mr. Herman Beach, of Bridgeport, Conn., was a recent visitor at the Club, and was entertained at dinner by Mr. Henry Dwight Stanley.

Visitors from out of town have been very frequent of late. Here are a few of the many names: Fred. W. Royce, Washington; Herman Beach and Nelson M. Beach, Bridgeport, Conn.; Chas. M. Peck, New Haven; G. W. Hoyt, Danbury, Conn.; Geo. L. Beetle, Chicago; C. A. Bragg, Philadelphia; F. E. Pettingell, Boston; L. Halsey Williams, Pittsburgh; Jas. O. Clephane, Philadelphia; Henry Gustave Rogers, Washington; John Siebert and August Kleb, Hanau, Germany; George Alfred Townsend, Washington, D. C.

New Members of the Club were elected at the last meeting of the managers as follows: John B. Campbell, New York; W. J. Johnston, New York; J. Barrè, New York; W. B. Cleveland, Cleveland, Ohio: J. M. Orford, Bridgeport, Conn.; Theo. Mosher, Chicago, Ill.; H. T. Paiste, Philadelphia; W. S. Hadaway, Boston; Geo. W. Adams, Boston; Chas. L. Tolles, Hartford.

Quite a Hartford Delegation was present at the Club Thursday evening of last week, including A. D. and C. E. Newton, and Chas. L. Tolles. For good looks this party would be hard to beat.

The Regular Monthly Meeting of the Electric Club will be held Thursday evening, December 18. Prof. Francis B. Crocker, of Columbia College, will lecture on "Electrical Units of the Present and Future." Professor Crocker will review the derivation of, and relations between, the present electrical units, and discuss the creation of other electrical units, which now are, or soon will be, required in electrical science and industry. It is proposed to treat this subject, as far as possible, in a non-mathematical manner, and give the most important facts regarding electrical units in popular, yet comprehensive, language.

A Brief Business Meeting of the Electric Club will be held at 8 o'clock the evening of the lecture, to discuss proposed amendments to the By-laws. The lecture will begin promptly at 8.30.

There was displayed on the Electric Club register, Saturday evening last, a unique combination of initials. Col. T. P. Ochiltree, T. P. O'Connor, M. P., and M. P. Handy, were the names registered, distinguished guests of member Joseph Howard, Jr. Such a heavy sprinkling of T's and P's and O's and M's was probably never seen before.

Boston Electric Club.

The Club held its annual meeting December 11, and elected officers for the ensuing year as follows; President, Capt. Eugene Griffin; vice-presidents, C. J. H. Woodbury, C. L. Edgar; treasurer, F. J. Boynton; secretary, R. F. Ross; historian, George W. Mansfield.

An Excellent Crayon Portrait of the retiring president, Henry B. Cram, of the Bernstein Electric Company, was formally presented to the Club in a suitable speech, by Capt. Wm. Brophy, of the Electric Mutual Insurance Company. The committee on entertainment is arranging for a series of papers on electrical subjects this Winter.

Dr. Norvin Green, president of the Western Union Telegraph Company, says: "At this date more than one-third of all the telegraph mileage of wires and poles, and of the number of telegraph offices, in the world, is in the United States, and we do nearly one-third the business of all the rest of the world put together."

There was considerable excitement among the city officials in Newark one day recently, over a big cable containing electric wires which the New York and New Jersey Telephone Company were stretching on the telegraph poles on Halsey street, between Market and Bank streets. Mayor Haynes ordered the men to stop work, but they refused to obey him. The foreman was arrested and taken to police headquarters, where he was locked up, and a squad of policemen were detailed to prevent the stretching of any more wire.

PERSONAL.

Col. George L. Beetle, accompanied by his wife, is visiting New York, a guest of the Hotel Dam. The many friends of Col. Beetle will regret to learn that he is still suffering from the effects of the Western railroad accident of which he was a victim several months ago, but he expects his rest in the East will be of much benefit.

The Electrical Supply Company, of Chicago, have secured for their engineering department, the services of Mr. M. M. Wood, lately district electrical engineer for the Edison General Electric Company, at Portland, Ore. Mr. Wood's extended experience in electric railroading and lighting will be of value to him in his new position.

Mr. William B. Knight, ex-city engineer of Kansas City, Mo., died on December 6, from injuries received in a railroad wreck a few days before. Mr. Knight had been connected with many engineering projects of importance, and among other offices which he held at the time of his death was that of general manager of the Patton Motor Company, of Chicago.

Mr. Geo. W. La Rue has accepted the position of the general sales agent of the Crocker-Wheeler Motor Company. Mr. La Rue is an experience electric motor representative, and was one of the earliest workers in the electrical field, having managed the work of constructing telegraph lines in this country and Mexico when men who understood such work were very scarce.

Mr. William J. Hammer is now no longer connected with any one electrical interest, but has widened the field of his labors by opening an office in Temple Court, New York city, as a consulting and constructing electrical engineer. Mr. Hammer is making this announcement to his host of acquaintances by sending them a handsome brochure describing and illustrating the many important electrical projects with which he has been connected. *Fac-simile* letters from Edison, Thomson, Wm. Wallace, James Allison, E. H. Johnson, Frank J. Sprague, Francis R. Upton, H. M. Byllesby and others, endorsing Mr. Hammer's abilities, are included in the pamphlet. The ELECTRICAL REVIEW knows Mr. Hammer to be one of the most fertile and active molecules in the body electrical to-day, and cheerfully adds its endorsement to those already mentioned. There is no need of wishing Mr. Hammer success, for that is sure to come to a man of his energy and experience.

Mr. Mackay's Property Now.

A deed of conveyance was placed on record December 11, in the Union County, N. J., clerk's office, by which the stock of the United Lines and Postal Telegraph Companies, sold at public auction at 10 Liberty street, New York, by William Armstrong, referee, in pursuance of a judgment obtained against the telegraph companies by the Farmers' Loan and Trust Company, and which was bid in by Robert G. Ingersoll for $390,000, has been transferred by him to John W. Mackay, who, by this, becomes the sole owner of the stock of the companies involved in the litigation. This deed of transfer is placed on record in every county in New Jersey through which the lines of the Postal Telegraph and United Lines Companies run.

The Brush Electric Company has brought suit against the Marble City Electric Light and Power Company, of Rutland, Vt., for infringement on the double carbon arc lamp.

The telephone wires in Ansonia, Conn., caused considerable trouble last week, and the principal fault was on new lines constructed last Summer. In building the new lines the construction gang did not allow for the action of heat and cold on the wire. In warm weather the metal was considerably expanded and the construction gang drew the wires just as tight as they could pull them. Now the cold weather is getting in its work and the metal contracts rapidly, and no allowance having been made for this the wires snap and break frequently.

To Celebrate the Work of the Inventor.

The proposition for holding a celebration of the beginning of the second century of the American patent system has assumed definite shape. The subject has been carefully considered by a large number of interested persons in Washington, and prominent inventors in other places have been consulted. Without exception, these persons strongly endorse the movement. The commissioner of patents, the director of the National Museum, and other government officials, take a deep interest in the undertaking, and will aid it in every proper way. The outline of a programme of the celebration, which has been suggested, provides for the preparation of as complete a history of the past 100 years' development of American inventions and of the patent system as can be obtained. It is expected that the various branches of the subject will be treated by the most competent men who can be selected for the purpose, and who will deliver addresses or present papers to the meeting. It has been suggested that this would be a fitting occasion on which to inaugurate a movement to secure the erection, at the National Capital, of a monument to American inventive genius and statues of inventors, but Professor Goode, of the National Museum, expresses the opinion that the literature of the subject which will be brought out will form the best monument that could be erected. Another important proposition which has been made, is that a permanent association of inventors and manufacturers of patented inventions be organized as a preparatory step towards united action in any matter of common interest. The question of patent legislation, as affecting such matters as a new building and better facilities for the patent office, more reasonable salaries for examiners, a court of patent appeals, etc., can, it is believed, be greatly and usefully influenced by such an association. The promoters of the World's Fair earnestly desire the success of the proposed celebration and the organization of the inventors, for the reason that such action will be of immense value as a preparation for the congress of inventors which is to be held at Chicago.

An executive committee, consisting of Hon. John Lynch, ex-member of Congress, chairman; Prof. J. E. Watkins, of the National Museum, secretary; J. W. Babson, of the patent office, M. C. Stone and Geo. C. Maynard, has been appointed, and the plan of action will soon be submitted to the inventors of the country. It is proposed to select a national committee of 100 leading men, representing all sections and all industries, to carry out the undertaking. During all the discussion of the matter the electrical industry has been regarded as one of the most important, and the active co-operation of the electrical fraternity is considered essential to the success of the celebration.

The Shipman Engine.

Our illustration shows the Shipman engine, an automatic petroleum-burning steam engine, especially adaptable for small isolated electric light plants. Three strong points claimed for it are uniformity of speed, a steady steam pressure and a regular supply and even level of water in the boiler. One of its essential points is that it is automatic, so that when once steam has been generated in the boiler, practically no further attention is required beyond that of opening and shutting the steam-valve whenever the engine is started or stopped, the fire, speed and water-feed being so arranged as to attend to themselves.

The engine is simple or compound and is built upon the same frame as the boiler. This latter is composed of tubes about 18 inches long, which are screwed into a flat, oblong chamber at one end and closed at the other, and is fired externally.

Two small aspirators or atomizers, taking steam from the boiler, suck up the petroleum, which is used as fuel, from a chamber below, and drive it into the furnaces in the form of a fine spray. Two torches ignite this spray as it passes inwards.

When first starting, a sufficient pressure is required in the boiler to work the atomizers, and for this a hand air-pump is provided. A few strokes of this pump will suffice to start the fires, and it is only necessary to pump slowly for five minutes to raise sufficient pressure of steam to keep them going, 15 minutes in all being required to get steam up to 100 pounds per square inch.

The engine is built by the Shipman Engine Company, 200 Summer street, Boston.

SHIPMAN ENGINE FOR ELECTRIC LIGHTING SERVICE.

—— The Thomson-Houston Electric Company, through the Western Isolated Lighting Department, reports the following recent sales: Bi-Metallic Mining Company, St. Louis, Mo., 200 incandescent lights; the Albert Dickinson Seed Company, Chicago, 100 incandescent lights, and G. B. Lewis & Company, Watertown, Wis., 100 incandescent lights.

—— The locomotives coming into Dayton after night provided with electric headlights attract considerable attention among traveling people and railroad men. Sitting in the cab of an engine supplied with this headlight is a decidedly new sensation. Small objects can readily be discerned at quite a distance off in good weather, and even the joints on the rails can be noticed many feet ahead. A headlight of this kind makes the track ahead as bright as day for a long distance.—*Dayton, O., Times.*

—— The judgment of the Circuit Court at St. Louis, Mo., in the case of the Pike Electric Company against the Richardson Drug Company, has been reversed and remanded. The action was brought to recover a reasonable value for labor and material used in putting in an electric light plant in the drug company's house. Before the plant was completed the house burned, and the electric company sued for what they claimed was due them under the contract. The plaintiff company obtained a judgment for $1,700.

ELECTRIC LIGHT NEWS

—— Denver's two electric light companies will consolidate.

—— Salisbury, N. C., wants an electric light plant. Write to the mayor.

—— It is reported that the electric light and gas companies of Annapolis, Md., will consolidate.

—— Cambridge, Ohio, has decided to put in an electric light plant at the expense of the town. It will cost $11,000.

—— Each year Parisians take out 7,000 patents, send and receive 50,000 foreign telegrams and 3,000,000 city telegrams.

—— Roanoke, Va., will probably hold an election to decide whether or not to issue $12,000 for electric lights and $5,000 for a fire alarm system.

—— Mr. J. P. Andrews, vice-president of the Edison Illuminating Company, of Newburgh, N. Y., died recently. At a special meeting of the directors, resolutions of respect to the memory of the deceased, who was highly esteemed by all who knew him, were unanimously passed.

—— At the annual meeting of the directors of the Albany, N. Y., Electric Illuminating Company held last week, Walter F. Hurcomb was re-elected president and the Hon. Edward A. Maher treasurer and general manager. The remainder of the old board of officers was also re-elected.

—— The commission of the State Reservation at Niagara Falls met last week, in New York City, and discussed the question of assuming the expense of lighting the Park and Falls of Niagara by electricity. They decided to ask the legislature for $25,000 for maintenance and improvement.

—— The German bank of Sheboygan, Wis., has assumed control of the Sheboygan Electric Light Company's plant, and has also taken up the mortgage of $25,000 given by President Clarke, for the money of which he was robbed in Milwaukee a few days ago. Including the bank's former claims against the company the plant costs it about $42,000.

—— It has not yet been demonstrated that there will be any economy in the city electric light plant, but there has cropped out a disposition to let the city go into all kinds of business and pay for its "keep." Practical men may be pardoned for being a trifle wary about trying on the Bellamy idea in Jamestown.—*Jamestown, N. Y., Journal.*

—— At a recent meeting of the Somerville and Raritan, N. Y., Electric Light Company a new board of directors was elected, composed of Messrs. J. W. Ballantine, A. M. Young, James P. Major, James L. Griggs, James Brown, L. M. Coddington and D. K. Craig. The organization of the board was as follows: J. W. Ballantine, president; D. K. Craig, vice-president; James L. Griggs, treasurer; James P. Major, secretary. It was decided to increase the capital stock from $30,000 to $50,000, in order to conduct a series of contemplated improvements.

—— The Willamette Falls Electric Company, of Hartford, Conn., is making some additions to the capacity of its electric lighting plant. The central station was put up somewhat more than a year ago, and was installed with Westinghouse alternating current apparatus of a capacity of 6,000 incandescent and 200 arc lamps. The plant is situated at Willamette, where the water-power of the "Falls" is utilized in the generation of the electric current. From the generating station to Portland is 12 miles, and for the purpose of transmitting the current over this distance, the installation consists of 3,000 volts dynamos. The light and the plant in general have given great satisfaction. The demand has increased and the company has given the Westinghouse Company the contract for apparatus to furnish an additional 100 arc lamps.

Call Box Decision.

Judge Shipman, of the United States Circuit Court for the District of Connecticut, rendered a decision December 9 in regard to the Firman signaling apparatus used in district telegraph systems. Suit was brought under the patent of Leroy B. Firman, No. 192,934, July 3, 1877, against the New Haven Clock Company. Judge Shipman held that there was no infringement. Firman's device comprises a signaling device composed of two wheels, one of which—the call wheel—contains unequally spaced notches which determine the call, the remaining portion of the rim being without teeth, the other wheel containing equally spaced notches to determine the special signal. After the call has been given, the teeth of a segment carried by the call wheel are brought into position to engage the teeth of the segment of the signal wheel, which is capable of being moved into position where its teeth will be engaged by the teeth of the call wheel. The claim upon which suit for infringement was brought was the fifth, as follows:

The combination with a signal writing wheel, moved by the same power, when the latter is provided with a number of equal spaced teeth, which write the signal desired by making a certain number of equal spaced impulses, substantially as specified.

The alleged infringing apparatus was the invention of Frank B. Wood, provided with two signal wheels geared to each other and both controlled by clock-work. The smaller wheel has a series of equally spaced notches and tends to transmit a series of makes and breaks at equal distances apart. The larger wheel has certain portions of the periphery cut away. Both are acted upon by opposite ends of the same contact spring. When both wheels are moved simultaneously in the same direction the small wheel makes a continuous series of contacts, those which are not needed being cancelled by the action of the cut away spaces in the larger wheel, the final result thus being to give the signal first and then the call. Judge Shipman held that if a literal construction were to be given the fifth claim involving a signal writing wheel with equally spaced teeth and a call writing wheel, regardless of the mode of co-operation to produce the result, in combination with a source of power operating the two wheels in such a way as to transmit a signal at one operation, that then there would be infringement, but that such a broad construction was unwarranted by reason of the prior state of the art, and that the scope of the claim must be confined to substantially the mechanism described, namely, "two wheels moving by the same power in succession and automatically, one of which produces a part of the signal by its sole action and the other of which produces the signal by its sole action," in spite of the fact that the Firman invention seemed to be the first one having two wheels which did both parts of the work automatically, inasmuch as two wheels acting in succession but operating by separate acts of the user had been known and a signal wheel sending in succession two sets of impulses had also been known prior to the Firman patent.

Board of Electrical Control.

At a meeting of the Board of Electrical Control, December 10th, after Corporation Counsel Clark had decided and approved of a proposition to allow the New York Subway Construction Company the right to sublet its low tension business to a company known as the Empire Company, a messenger came in and handed to Mayor Grant an injunction granted by Judge Dugro restraining the board from granting the request. The courts will probably be called upon to settle the matter.

Annual Dinner of Edison Men.

The office employés of the Edison General Electric Company, Seventeenth street and Avenue B, held their first annual dinner Saturday evening of last week, at Morello's, West Twenty-ninth street. Some 40 sat down. Mr. J. Hutchinson, the assistant manager, occupied the chair, filling the same to the satisfaction of all. The dinner was all that could be desired. During the evening, music, instrumental and vocal, and speech-making were in order. Amongst those present were: J. Hutchinson, assistant manager; C. E. Estabrook, John McGhie, A. Weber, James T. Robb, C. A. Stevenson, F. A. Stevenson, C. T. Wade, G. Stanmore, A. Metzger, G. Mais, A. B. Herrick, R. Lowitz, L. V. Vogel, J. F. Delamater, R. E. Gridley, C. J. Newall, J. B. Wicks, Fred. Kasselbaum, F. Stoltz; A. H. Thorne, J. H. Delaney, Frank Fisk, C. Noll, H. Hoffman, T. Nivens and others. After the dinner a number of them adjourned to the employés' ball, at the Lyceum, Thirty-fourth street, near Third avenue.

The New Bain Insulator.

We present this week a cut of a new high resistance glass insulator, the invention of Mr. Foree Bain, of Chicago. The insulator is made extra strong and is especially adapted to heavy work, such as carrying large primary wires, particularly feeder wires for electric railroad work. The corrugations which are made both outside and inside of the apron increase the distance from the wire to the pin fully 100 per cent., and it is claimed that water will in passing over the edges of the rings become thin and broken, and on reaching the inside of the glass will drop off rather than creep over the inner obstructions to the pin.

In this insulator the many surfaces will reflect the light under the glass in such a way as to keep insects out, obviating a source of such annoyance where plain dark glass is employed. This insulator will cost a little more to manufacture than the ordinary plain glass insulator, but the inventor claims that an advance of a few cents per mile in the cost of construction will not be any objection where a high class of work is desired.

Mr. Bain has assigned his patent to the Central Electric Company, of Chicago, who are now the sole owners and by whom the article is being placed upon the market.

NEW BAIN INSULATOR—CENTRAL ELECTRIC CO., CHICAGO.

Electrical Supplies and Pies.

The Keystone Electric Works have recently built a fine three-story business block on Fourteenth and State streets, says the Erie, Pa., *Herald*. The concern formerly occupied a modest store-room in a frame building on Peach street, north of and near the Union Depot. When it vacated the store its sign of "Electric Supplies," etc., in large gilt letters, was left on the windows. Lately an eating house and lunch emporium has been established in the room recently occupied by the Keystone Works. But the "Electric Supplies" sign still remains on the windows.

In the latter are displayed toothsome pies, and nice cakes, and roasted fowl, and dishes of pork and beans, and other victuals in tempting array. Two Greene township farmers, who were seeing the Erie elephant, paused in their mad career before those lunch-room windows recently and gazed at the display of delicacies in open-mouthed astonishment.

"I say, Jake," began the first agriculturist, with a nod at the provisions and the sign, "did you ever see the beat of that? Electrical supplies! And there's pies and chickens and sandwiches!"

"That knocks me out," replied Jake, even more surprised than his companion; "bless me if I ever heard of electrical grub before. But they do most anything in this big city nowadays. They run street cars by electricity, and you can't see what's moving them. Like as not they bake their pies and cakes and chickens by electricity."

And with another wondering look at the tempting lunch displayed in the windows, the farmers passed on, resolved to astonish the natives of Greene township on their return there with their tales of the electrical pies, chickens, beans and sandwiches the good people of Erie eat nowadays.

The following petition was read to the Brooklyn, N. Y., Board of Aldermen last week:—

"Gentlemen—On behalf of the officers and stockholders of the Brooklyn Electric Light and Power Company, I respectfully and earnestly request that you will take as speedy action as possible on the numerous applications made by the company during the period of nearly four years past, asking for the privilege of lighting up a certain district of this city with arc and incandescent lights. The company has waited patiently for the granting of such franchise, and has suffered the loss of a large amount of money, and is still under great expense, and a large number of citizens of the eastern district have also waited anxiously for you to grant the privileges asked for by the company, in order that they may have the benefits of competition. If there are any reasons why the company should not be allowed to transact a legitimate business in this city, its members would like to know them. Your speedy action in the case would be no more than an act of justice to the company and to the citizens who desire to burn its lights. Respectfully,

"NOAH L. COCHEU,
"President B. E. L. and P. Co."

The petition was referred to the committee on lamps and gas, without discussion.

BOOK REVIEWS.

"The Sidereal Messenger" for December has been received.

A copy of the commemorative address delivered by Augustus Lowell at the twenty-fifth anniversary of the Massachusetts Institute of Technology, celebrated last June, has been received.

The first installment of selections from "The Memoirs of Talleyrand," which is to appear in the January *Century*, will contain a sketch of the author's strange and lonely childhood, an account of his entry into Parisian society, his estimate of La Fayette, some account of the beginnings of the French Revolution, a striking passage concerning the Duke of Orleans, an account of Talleyrand's residence in England and America, and of a most interesting conversation between Talleyrand and Hamilton on the subject of free trade and protection.

Scribners Magazine for December is a holiday number (with a special bronze cover) containing seven illustrated articles, in which a remarkable list of artists is represented, including Robert Blum, Domenico Morelli, Harry Furniss, Howard Pyle, A. F. Jacassy, C. D. Gibson, W. L. Taylor and W. L. Metcalf. Among the contributions are Sir Edwin Arnold's first paper on Japan; Humphry Ward's description of the famous London picture salesroom, known as "Christie's;" W. H. Rideing's picturesque account of Amy Robsart's country; A. F. Jacassy's article on a great contemporary artist—Domenico Morelli; and three short stories, which in feeling and motive are especially suited to the Christmas season.

"Practical Electrical Engineering," a complete treatise on the construction and management of electrical apparatus as used in electric lighting and the electrical transmission of power, published by J. A. Penman, 7 Warren street, New York.

This book has been written to afford practical assistance to electrical engineers. The rapid progress in electric lighting and transmission of power of late years is a sufficient warrant for a book especially devoted to these interests. In the engineering operations involved in the construction of central stations and lighting and power systems, an engineering specialty is growing up, which involves not only the skill of electrical engineers but of mechanical engineers as well, a knowledge of the character, construction and requirements of engines and boilers, gearing, lubrication, masonry and other departments of mechanical engineering being as necessary to secure the best results as skill in planning the most suitable electrical installation. As stated in the prospectus of this work, the central station is taken as the text, and the various questions connected with it are discussed most fully; cognate subjects, however, such as lead up to those most fully considered are also discussed.

The most eminent contributors have been secured to write upon the various subjects of which the book treats. Mr. Gisbert Kapp contributes the section devoted to the design and construction of dynamos; Mr. Anthony Reckenzaun contributes the section on tramway work and that on secondary batteries and their applications; Mr. W. W. Beaumont discusses questions relating to gearing and dynamometry; Mr. C. Capito treats of boilers and engines especially qualified for electric lighting purposes; Mr. J. Swinburne contributes the section on the manufacture of incandescent lamps, Mr. P. Sellon treats of the construction of arc lamps, and Mr. H. Swan contributes the part treating of interior wiring, fittings, safety devices and switching apparatus.

The work is more practical than scientific in character, and is, therefore, better qualified to meet the wants of the active electrician. The eminence of the contributors above noted, all of whom occupy a distinguished position in the electrical field, would alone be sufficient endorsement of the work to make it sought after by every electrician. Its merits are far above the very modest claims urged in the prospectus. The book comprises 18 parts of between 30 and 40 quarto pages, and will be delivered monthly or as published at 75 cents a part. It is a work which should, beyond question, be in the hands of every one who aspires to the title of an electrical engineer. Parts I, II, III and X. are before us. The pages are copiously illustrated with fine engravings, which force home upon the reader the truths set forth in the text. Subjects of live importance are discussed in a manner which brings them within the mental grasp of an ordinarily educated reader. Many of the text books on electricity are freely sprinkled with difficult mathematical formula, the deduction of which is appreciated only by the few. In this work, however, the graphical method of illustration is freely adopted, thus enabling the eye to translate characteristics by means of curves, which mathematically expressed would be totally unintelligible except to the expert mathematician. Not only the electrical, but also the mechanical problems entering into the work of an electrical engineer are ably discussed. Steam-engines, gearing, quality of material, cost of building, maintenance, equipment, problems relating to central station site, foundations and numerous other subjects allied to lighting and power installations, all receive full consideration. We unqualifiedly commend the work to members of the electrical fraternity as one which will form a valuable addition to their libraries.

The Street Railroad Pass.

The street railroad pass, like ice, is no longer a luxury. It is too common for that. The taxes on the companies may arouse bitter complaint from stockholders; they may profess themselves unable to accommodate their patrons by reason of poverty; they may overwork and underpay their men, and they may default in their interest account; but the deadhead is always with them. Here in Newark, the Essex, the Rapid Transit and the South Orange Companies are all equally liberal, and it is a lonesome trip when a little book and a little ticket fail to indicate the presence of the alderman, the daily newspaper man or the "influential citizen." Of course, where one railroad does it the others must follow suit; but is it not about time that this petty bribery ceased on all lines, and the saving on this account were applied to some public benefit? Of course, the companies do not pay for these free rides; that is done by the people who pay their fares. The subject came up afresh last week when the *Sunday Call* again had occasion to decline passes; but the nuisance of the pass is perennial, for it constantly makes impossible public benefits which the companies could otherwise easily be made to yield.—*Newark, N. J., Call.*

The Oakland and Berkely, Cal., Rapid Transit Company has awarded the contract for building a car house 50x190 feet. The company will have nearly 12 miles of track when it begins operations next Spring.

New Business of the Westinghouse Company.

Since December 1, the Westinghouse Electric and Manufacturing Company have received contracts for alternating current electric lighting apparatus for a capacity of 5,650 incandescent and 120 arc lights. Olean, N. Y., has contracted for an increase of its plant, and when the new apparatus has been installed, the plant will have 1,400 incandescent lamps capacity.

Iron Roofs.

Our illustrations show a roof built by the Berlin Iron Bridge Company, of East Berlin, Conn., for the Ansonia Brass and Copper Company, at Ansonia, Conn. The drawing was made from a photograph taken from a point in the trusses.

The trusses are entirely of iron, connected by wooden purlins and covered with matched boards and tin. Between the two buildings the trusses are supported on columns and

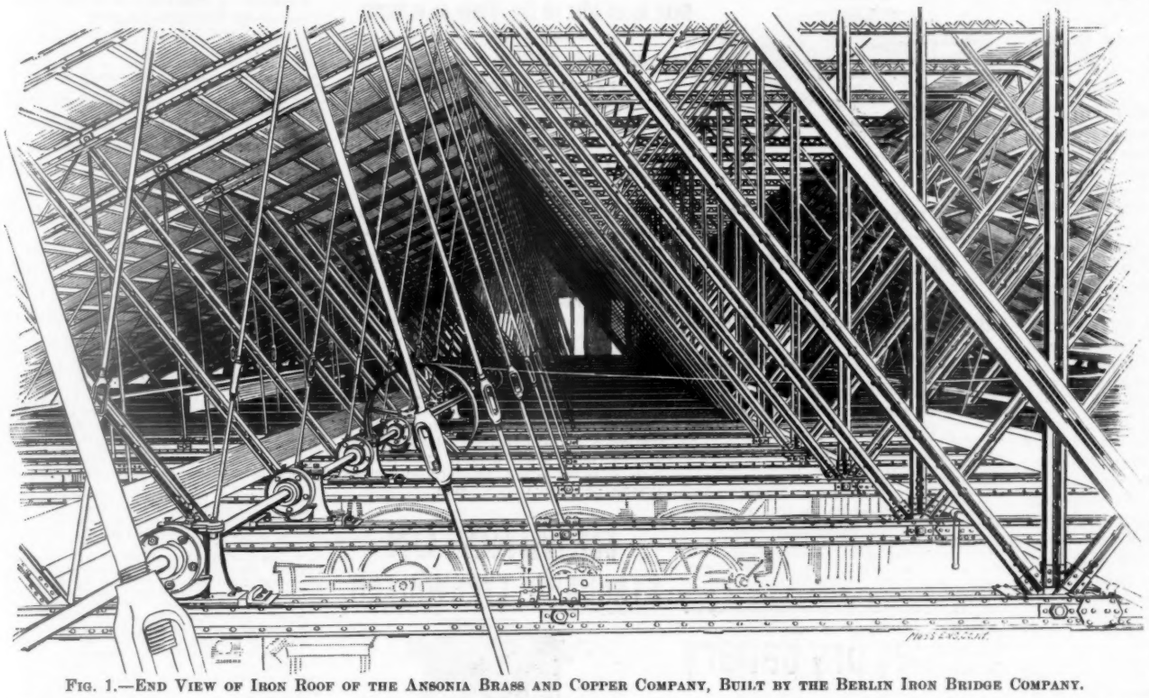


FIG. 1.—END VIEW OF IRON ROOF OF THE ANSONIA BRASS AND COPPER COMPANY, BUILT BY THE BERLIN IRON BRIDGE COMPANY.

The alternating current electric lighting plant of the Missouri Electric Light and Power Company, in St. Louis, Mo., has grown so rapidly that it has now become one of the largest central station plants of alternating current electric lighting in the United States. The Company was organized in the early part of 1887, with apparatus of a generating capacity of 12,000 lights. This was the first contract for Westinghouse alternating current apparatus which had come from St. Louis. An increase soon had to be made in the generating capacity. A 3,000 light Westinghouse alternating current dynamo was added, and for a time the immediate wants of the company's patrons for lighting were complied with. But it was only temporary, and then the company added two more 3,000 light Westinghouse alternating current dynamos to the capacity of the station. The company now had a generating power by which it was enabled to furnish 21,000 sixteen candle-power incandescent lamps. A few weeks ago the Westinghouse Company received another contract for the installation of one of its 3,000 light apparatus. This will give the Missouri Electric Light and Power Company alternating current apparatus with a generating capacity of 24,000 incandescent lamps, which makes it, probably, the largest alternating current central station plant in America west of the Allegheny mountains.

The Pennsylvania Railroad Company is rapidly increasing the number of electric light plants along its lines, where a good light is of the greatest consequence and advantage to the railroad. Some time ago, the Westinghouse Company installed a plant of its alternating current arc light apparatus at the Altoona shops. The operation of that system has given such satisfaction that the railroad management lately decided to have a similar plant put up at Wall station, which is one of the most important points on the entire Pennsylvania Railroad system. The plant will have a capacity of 120 arc lamps.

The electric light plant at Wilmerding, Pa., the new town near Pittsburgh, where the Westinghouse Air Brake Works are located, is now being increased from a capacity of 1,500 to 2,000 lights.

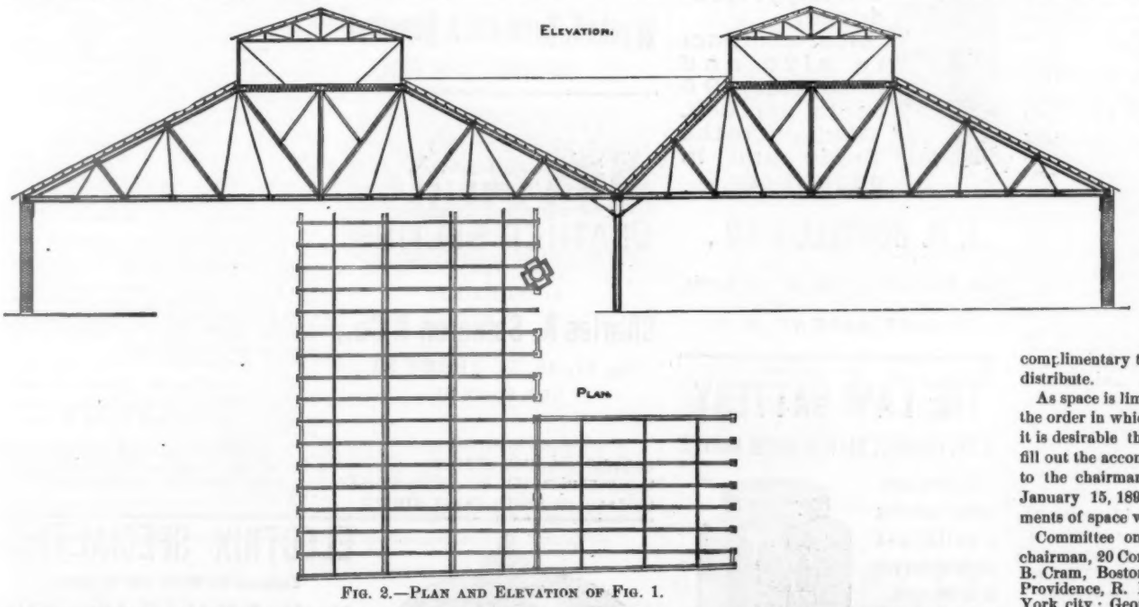


FIG. 2.—PLAN AND ELEVATION OF FIG. 1.

heavy plate girders. The trusses are designed to conform in outline to other adjacent buildings. The building consists of two parts, that shown on the left (Fig. 2) being 250 feet long by 110 feet wide, and that portion shown on the right being 91 feet long by 70 feet wide. The trusses are placed 10 feet apart and have sufficient capacity over the portion where the lighter machinery is placed to lift 8,000 pounds, and certain trusses covering the portion of the building where the heavy machinery is located have a capacity to lift 18,000 pounds. Where the conditions of span and loading are extreme, as in the present case, a roof can be built nearly if not quite as cheaply of iron as of wood.

A large number of electric light stations recently built are constructed with these iron roofs. This is a class of high grade work that the REVIEW is pleased to commend at all times.

Getting Ready for the Providence Meeting.

The Committee on Exhibits of the National Electric Light Association has issued the following notice under date of December 13:

In connection with the meeting of the National Electric Light Association, in Providence, R. I., on February 17, 18 and 19, 1891, it is proposed to hold an exhibition of electrical apparatus and appliances, especially such as are used in the business of furnishing light and power. To this exhibition all associate members are earnestly requested to contribute.

A suitable hall has been secured opposite the hotel which will be the association headquarters, and through the courtesy of the Narragansett Electric Lighting Company, all the electric current necessary will be provided. There will be run into the hall three circuits, viz.: 1st, An incandescent alternating current converted to 50 volts; 2d, a 500 volt direct current from Thomson-Houston generators; 3d, an arc current of $6\frac{5}{10}$ amperes.

There will be no charge for space or current to exhibitors, who must, however, be associate members of the association. The installation and care of exhibits will, of course, be at the expense of exhibitors.

As this meeting may be virtually said to mark the close of the first decade of electric lighting commercially, it is suggested that as far as possible, efforts be made to show the progress in the art, by exhibiting the earlier forms of apparatus and appliances, together with those embodying the latest improvements.

The exhibition will be open on Tuesday, February 17, and close on Thursday evening, February 19, and it will be open day and evening. Exhibits may be installed on the Saturday and Monday previous, and removed on the following Friday.

It is expected that this exhibition will prove very attractive to the Providence public, as well as to the members of the association. To exclude the street gamin element, a nominal admission fee (25 cents) will be charged, but it is intended to circulate complimentary invitations freely among the representative business men of the city, and exhibitors will be supplied with as many complimentary tickets as they may desire to distribute.

As space is limited and will be allotted in the order in which applications are received, it is desirable that all intending exhibitors fill out the accompanying blank, and send it to the chairman of the committee prior to January 15, 1891, at which date all allotments of space will be made.

Committee on Exhibits: C. H. Barney, chairman, 20 Cortlandt street, N. Y.; Henry B. Cram, Boston, Mass.; Van A. Thomas, Providence, R. I.; Wm. J. Hammer, New York city; George C. Maynard, Washington, D. C.; Wm. A. Kriedler, Chicago, Ill.; Luke Lilly, Cincinnati, O.

The Appleton, Wis., council has found it necessary to have the city lighted by electricity, because, it is said, so many women are insulted nights on the dark streets. The city will issue bonds for $43,000 to put in an electric plant for the public lighting.

Roland T. Oakes & Company, electrical contractors, of Holyoke, Mass., have just finished tubing and wiring a college fraternity house and Professor H. H. Mills' residence at Amherst, Mass. Several Holyoke contracts have also recently been completed.

The Mather Electric Company, Manchester, Conn., in addition to the many improvements and enlargements made during the past season, has procured a new 75 horse-power boiler which will soon be placed in position to meet the increasing requirements for power.

The Weston Electrical Instrument Co., Newark, N. J., are just now completing some new electrical instruments which will soon be put upon the market. Their manufacturing facilities, including special tools and expert help, are of a superior character. Business is brisk with this company, the increase having necessitated a removal to larger quarters at 114 and 116 William street, Newark.

The Arcade File Works, the oldest existing, and one of the largest and most enterprising concerns in the country, located at Sing Sing, N. Y., are considering the advisability of moving their entire plant to a location where increased facilities for manufacturing may be had. They find this step necessary owing to the steady growth of their business and lack of space in which to extend their works. The concern employs about 150 hands, and propose enlarging so as to double their production.

The Westinghouse Electric and Manufacturing Company completed during November a month of business which has been one of the largest in the history of that corporation. The company shipped an aggregate of incandescent alternating current light machines of 30,000 sixteen candle-power lamp capacity. Among the places where the Westinghouse system has been installed are: Philadelphia, Pa., 750 incandescent and 300 arc lamps; South Omaha, Neb., 750 lights; Ballston, N. Y., 750 lights; Lima, O., 1,500; Aspen, Colorado, 750; Wellsburg, W. Va., 500 incandescent and 25 arc; Charleston, W. Va., 750 increase; Portland, Oregon, 100 arcs.

Joseph Ketchum & Company, 46 and 48 Lexington avenue Brooklyn, have recently equipped an extensive plant for the manufacture of cold process lead casing presses. The method employed is covered by recent patents and they claim a more homogeneous product and entire absence of pin holes and granulation. We understand that they not only cover cable at their establishment but are prepared to equip cable and wire manufacturers with their presses under favorable conditions. The samples of their work certainly seem to bear out their assertions regarding the quality of their product. They are also introducing a new insulating compound which is said to possess peculiar and valuable properties.

To Bid Again.

The gas commissioners, on December 11, decided to advertise again for bids for lighting the city of New York by electricity during 1891. Bids will be opened December 23, at one o'clock. If the average price approaches 40 cents per lamp, per night, it is said that contracts will be made. The latest batch of bids averaged not quite 44 cents.

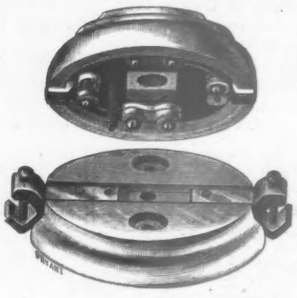
TO LET.—Two elegant lofts in new brick factory, 25x60, light all around, within five minutes of depot to all Rail Roads of the country. Power if desired. Rent low.

CURLEY & BURCHARDS,

38 FRANKLIN ST., GREENPOINT, L. I.

5,000

PAISTE PORCELAIN PENDANT CUT-OUTS IN STOCK



Must be Sold to make Room for a New Line of Goods.

Make us an offer on the Whole or in Parts.

WILL BE SOLD CHEAP.

SAMPLES FORWARDED FREE.

H. T. PAISTE,

12th and Market Sts., PHILADELPHIA, PA.

NOTICE TO INVENTORS.

THE ELECTRICAL REVIEW PATENT BUREAU

Is splendidly equipped for transacting patent business—procuring patents in the United States and foreign countries, and reporting on infringement, validity, patentability, etc.

It was Established to Supply a Real Want, indicated by numerous inquiries for an attorney familiar with both Patent Office procedure and Electricity.

Its Manager was for many years an examiner in the Electrical Department of the United States Patent Office, and has had a wide experience as an attorney.

If you want Prompt and Efficient Work at moderate rates, write the Patent Bureau when you have need of assistance from a patent attorney.

U. S. and foreign patents secured; caveats, trade-marks, labels, design patents, copyrights. Special searches and reports on validity or infringement necessary in prosecuting or defending patent suits.

Burnley Dry Battery

PATENTED JAN., 1890.

STRONGER than any Open Circuit Battery on the Market. BETTER than any other Dry Battery yet produced. Most compact in size and cheapest. 90 cents per cell. Discount to the Trade and in quantities.

J. H. BUNNELL & CO.,

Sole Manufacturers and General Agents,

76 CORTLANDT ST., N. Y.

THE LAW BATTERY

IS THE CHEAPEST BATTERY ON THE MARKET.

We think twice before spending a Dollar and would advise you to do the same.

We make a specialty of Pure Zinc and Pure Sal-Ammoniac.

LAW TELEPHONE CO.,

85 & 87 JOHN ST., NEW YORK.

IF YOU HAVE A BATTERY—Gravity or Leclanche—use the Delany battery strip. It prevents the salt from creeping, keeps batteries and shelves clean, prevents local action, and prolongs life of battery. Warranted. Price per dozen—Gravity, 60 cents; Leclanche, 50 cents.

PATRICK B. DELANY,
SOUTH ORANGE, N. J.

"I advise all parents to have their boys and girls taught shorthand writing and typewriting. A stenographer who can typewrite his notes would be safer from poverty than a great Greek scholar."—CHARLES READE, on "The Coming Man."

REMINGTON STANDARD TYPEWRITER.

For 15 years the Standard, and to-day the most perfect development of the writing machine, embodying the latest and highest achievements of inventive and mechanical skill. We add to the Remington every improvement that study and capital can secure.

Wyckoff, Seamans & Benedict,

327 BROADWAY, NEW YORK.

PATENT PERFORATED ELECTRIC LEATHER BELTING

MANUFACTURED BY

Charles A. Schieren & Co.,

45, 47, 49, 51 FERRY ST.,

COR. CLIFF ST.

BRANCHES:

BOSTON, 119 HIGH STREET.
PHILADELPHIA, 226 NORTH 3d STREET.
CHICAGO, 46 SOUTH CANAL STREET.

ELECTRIX SWITCH.

ELECTRIX SPECIALTIES.

Endorsed the World over by Users.

Simple. Reliable. Indestructible.

DEALERS REPORT QUICK SALES.

CORRESPONDENCE INVITED.

THE STAR ELECTRIX CO.,

1320 Wallace St., Philadelphia, Pa.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON DECEMBER 9, 1890.

442,104 Electric signal for engines; Michael Conley, Chicago, Ill., assignor of two-thirds to James C. Ricketson and Frederick B. Ricketson, Milwaukee, Wis.
442,114 Electric gate; Harleigh Gillette, Highland Park, Ill.
442,115 Tanning by electricity; Lorentz A. Groth, London, England.
442,126 Electrical vote recorder; Sylvanus D. Locks, Hoosick Falls, N. Y.
442,127 Hanging device for electric arc lamps; James A. Lounsbury, Chicago, Ill., assignor of one-half to G. A. Edward Kohler, same place.
442,139 Multiple telegraph or telephone; Abner M. Rosebrugh, Toronto, Canada, assignor to the American Bell Telephone Co., Boston, Mass.
442,140 Circuit for electric railways; Frank W. Sabold, Albany, N. Y.
442,143 442,145 Multiple switchboard system. 442,144 442,146 Telephone exchange apparatus; Chas. E. Scribner, Chicago, Ill., assignor to the Western Electric Co., same place.
442,162 Underground electric conduit; Homer H. Young, Kansas City, Mo.
442,173 Electric motor or dynamo electric machine; Chas. E. Dressler, New York, N. Y.
442,187 Method of and apparatus for manufacturing secondary battery electrodes; James G. Johnston, Denver, Col.
442,203 Separating diaphragm for electrolytic cells. 442,204 Diaphragm for electrolytic cells. 442,332 442,334 442,396 442,594 Electrolytic apparatus. 442,333 Apparatus for use in electrolysis. 442,335 Process of treating asbestos. 442,336 Carbon electrode and method of making the same; Isaiah L. Roberts, Brooklyn, assignor of one-half to Thos. H. McGraw, Poughkeepsie, N. Y.
442,208 Speed regulator for electric motors; William W. Schiffmann, St. Paul, Minn.
442,232 Attachment for span wires for suspended electric conductors; Frank Mansfield, New York.
442,267 Telegraphy; Edward B. Ives, New York, N. Y., assignor to James M. Seymour, same place.
442,270 Device for attaching incandescent electric lamps to gas fixtures; Norman Marshall, Boston, Mass., assignor to the Star Electrix Co., Philadelphia, Pa.
442,287 Incandescent lamp socket; Geo. W. Hunt and Albert E. Rich, Brooklyn, N. Y.
442,327 Mechanism for controlling torpedoes, etc.; Geo. R. Murphy, London, England.
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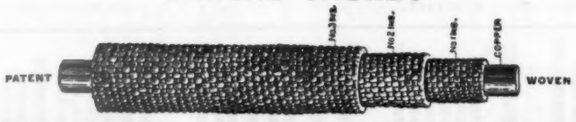

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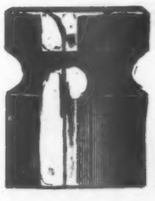

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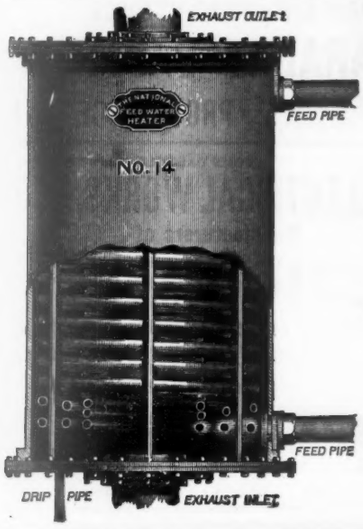

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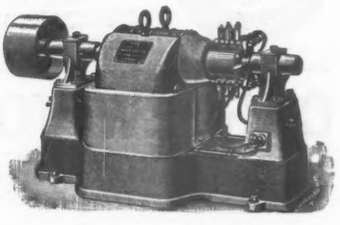

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C	8	.....	.....	.....	6.5	1½	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1¼		530
C	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	2½		780
E	.....	20	.....	.....	12.5	2½		780
E	.....	.....	26	.....	13.0	2¾		780
F	20	.....	.....	.....	15.0	3		990
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G	28	.....	.....	.....	21.0	4½		1,360

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C	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
C	.....	.....	45	.....	21.0	4		1,360
C	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
I	.....	.....	64	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
I	.....	65	.....	.....	38.6	8		2,290
J	.....	.....	83	.....	38.0	8		2,290
J	64	.....	.....	.....	46.5	10		2,770
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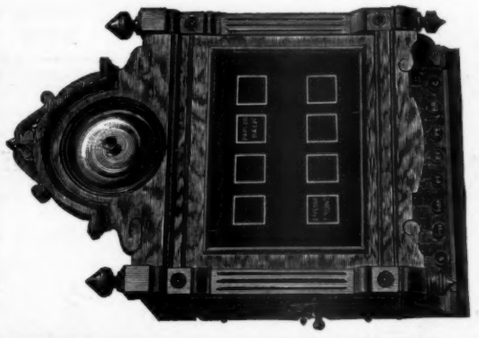

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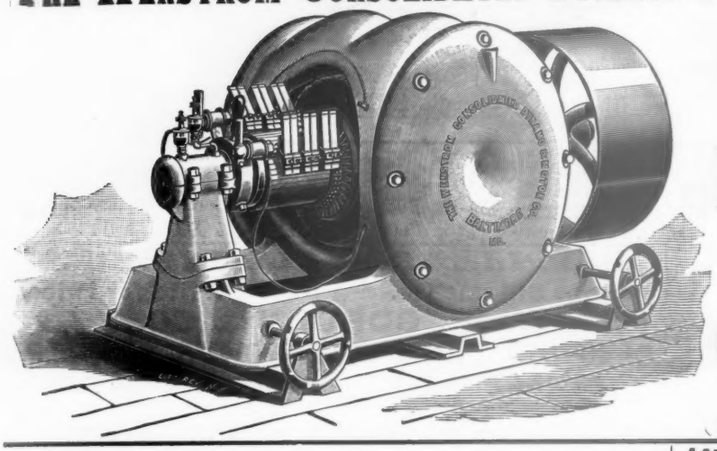

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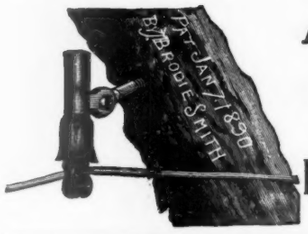

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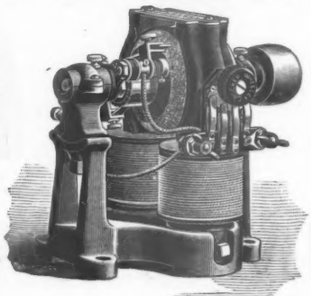

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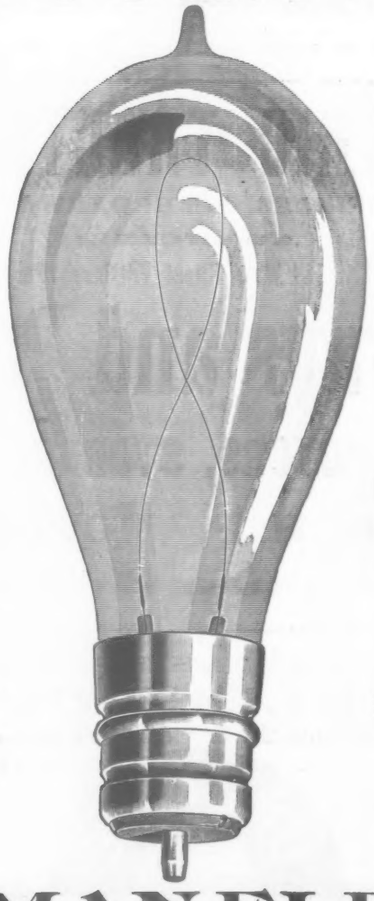

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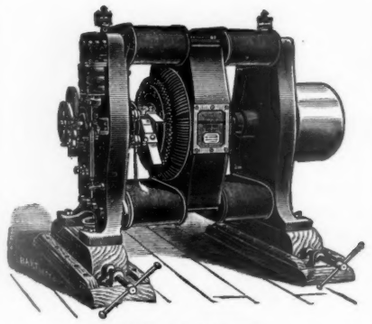

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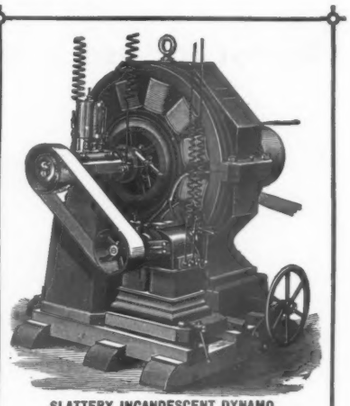

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THIS Company owns all of H. SPLITDORF'S CELEBRATED PATENTS for covering all sizes of wire. All wire manufactured under these patents has this trade mark affixed. NONE GENUINE WITHOUT.

The advantages of the SPLITDORF WIRE over any other insulated wire are:

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5th. Since the strength of a magnet depends upon the number of its convolutions, SPLITDORF INSULATED WIRE will produce a much stronger magnet of a given size than any other wire in the market.

Wire covered with cotton by the SPLITDORF patents is fully equal in every respect to wire covered with silk under any other process, while SPLITDORF silk covered wire is far superior to the ordinary silk covered wire, in that so much finer silk can be used and such a decrease in bulk effected.

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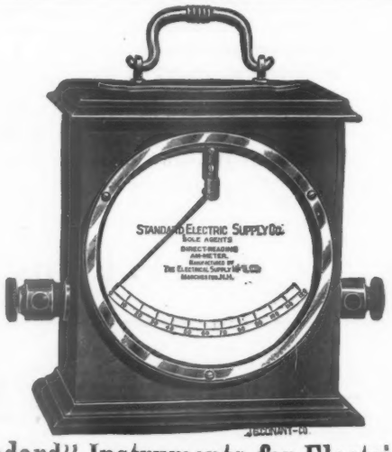

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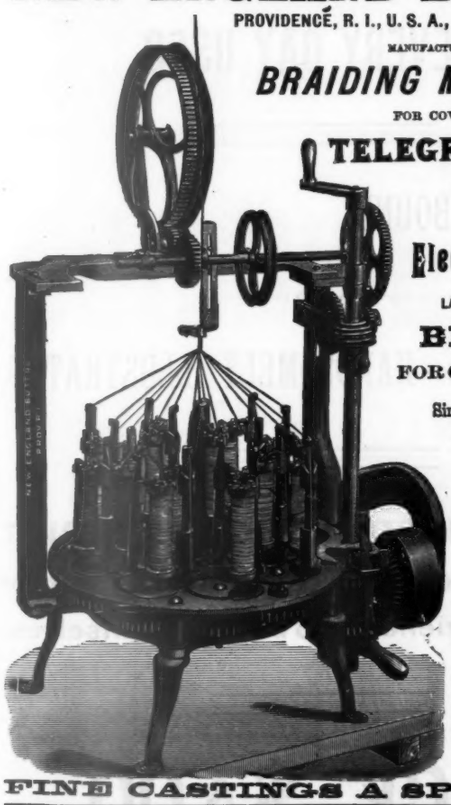

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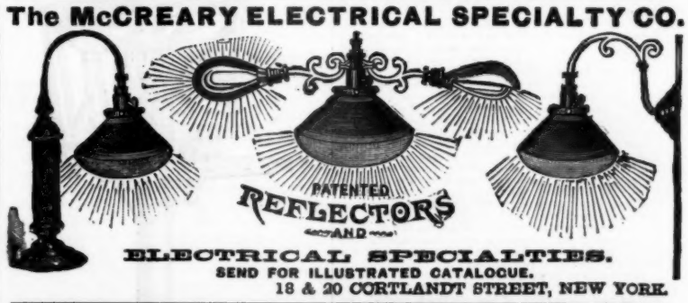

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Silk & Cotton Covered Flexible Conducting Cord of various sizes for Incandescent Lighting.

Spikes, Pole Steps, Lag Screws, Drive Screws, Turn Buckles, Etc.

NOTICE TO CONTRACTORS.

OFFICE OF CITY CIVIL ENGINEER,
INDIANAPOLIS, IND., Dec. 4, 1890.

Notice is hereby given that sealed proposals will be received by the common council of the city of Indianapolis on Monday, Jan. 5, 1891, for lighting the city of Indianapolis, Ind.

FOR ELECTRIC LIGHT.

Proposition to be for 400 lights; for 500 lights; for 600 lights; for 700 lights, and for 800 lights, all to be 2,000 standard candle-power arc lights, suspended on mast arms.

All bids to be made to comply with provisions of general ordinance No. 41, 1888, of this city, providing for the placing of all electric light wires within North, South, East and West Sts. to be laid underground, outside of which boundaries wires may be strung on poles.

The contractor to furnish all necessary material, and do all the work of whatever kind necessary to construct, equip and maintain good and substantial electric installation, complete and ready for operation for lighting the city, and when the same is completed shall operate the same in its entirety for a trial period of sixty (60) days.

The lights furnished shall be as good as the best standard 2,000 candle-power lights used in any city in the United States.

At the end of the trial period, if the lights are as good as above specified, and should the performance of the entire plant prove satisfactory, the city will accept the same, and the rental shall date from the beginning of the trial period. But should the performance of the entire plant not be satisfactory to said city, the plant will not be accepted, and no rent will be paid until said plant is made, in its entirety, perfectly satisfactory to said city.

The equipment must in all respects be of the best manufacture and of the latest and most approved design.

Bidders to make their propositions upon the basis of an all night lighting schedule, begining one-half hour after sunset and ending one-half hour before sunrise; also on a basis of a five years' and also on a ten years' contract. Lights to be located under the direction of the committee on public light of the common council, and board of aldermen and the city civil engineer.

The plant will consist of an equipment capable of operating and sustaining circuits upon which to operate arc lights 2,000 standard candle-power each.

Not more than 50 lamps to be lighted by any one circuit.

The mean photometric candle-power of the lights, measured at an angle of 45 degrees from a horizontal, shall be as great as that shown by the best standard 2,000 candle-power arc light now in use in the United States.

All intermediate points shall be straight, live white cedar, shaved, not less than six inches in diameter at the top, and shall not be less than 30 (30) feet in length, to be set five (5) feet in the ground.

All poles, including cross arms, pins and brackets to be painted two coats of good paint of such color as the city engineer may designate.

All poles to be set plumb, true to line, and guyed whenever direction changes or otherwise necessary.

Poles to be set not more than 140 feet apart in any case, and estimated at the rate of 40 poles per mile.

All wires must be thoroughly insulated with some good material not easily abraded and impervious to moisture, and the insulation to be guaranteed water and weather-proof for three years. All joints to be soldered, and covered with at least five layers of Kerite tape, or some other non-conducting material equally as good.

When the direction changes an insulated loop guard shall be attached to the pole to hold the wire, in case of breaking of pin or brackets. Wires must, in all cases, clear the ground at least 25 five feet and must be kept clear of contact with any adjacent lines or wires. Insulation from grounding from outside contacts must be perfect.

All wiring and other work shall, in addition to the above, be done according to the rules and regulations of the "National Board of Underwriters."

The contractor will be required to enter into a written contract agreeing to perform the whole work according to the true intent of the above specifications, and shall state the time within which he will do the whole of said work and have the plant in operation; said time shall not exceed six months after the date of signing the contract.

The contractor shall be required to furnish a bond with satisfactory sureties protecting the city from liability on account of infringements of patents or otherwise, and also from all damages and costs of suits that may arise on account of construction, maintenance, rental, use, or ownership by the city, and guaranteeing the full and faithful compliance with all the terms of this contract with the city.

All work to be done under the direction and supervision of the city civil engineer, and any points omitted in the above specifications shall be subject to directions given by him from time to time during the progress of the work.

The contractor will be required to accompany his bid with a certified check for five thousand dollars ($5,000), payable to the mayor of said city of Indianapolis, Indiana, for said city, and the amount thereof shall be retained by said city of Indianapolis, as liquidated damages in the event of his failing to enter into a contract, and file proper bond within ten (10) days from date of award of contract, and to be returned to said contractor upon his filing a good and sufficient bond within such time for the faithful performance of the contract. The contractor to erect the plant as above, furnishing all the necessary appliances and doing all the work of constructing and operating and maintaining the same, and to furnish lights as above specified for a given sum per light per annum.

The rental to be paid monthly.

The city shall be granted the option of purchasing at the expiration of the contract period, the entire plant of any contracting company, at a price that shall be fixed by a board consisting of five members, two to be selected by each of the contracting parties, and the fifth to be selected by said four members so selected by said contracting parties. The city shall give to said contracting company six months' notice, immediately prior to the expiration of any such contract, of the city's intention to purchase the plant.

The common council and board of aldermen reserve the right to reject any and all bids.

FOR GAS LIGHTS.

For bids to furnish gas lights as follows: Five hundred lights, 1,000 lights, 2,000 lights, 3,000 lights, 4,000 lights.

FOR VAPOR LIGHTS.

For vapor lights as follows: Three hundred lights, 400 lights and 500 lights

Bidders for furnishing gas or vapor lights, or both, to bid on a basis of one, two and three years contracts, and shall each submit with their bids certified checks for $2,000, guaranteeing faithful compliance of their contracts. All bidders for electric, gas or vapor lights shall bid on a basis of an all night lighting schedule, and for the lighting, cleaning and repairing of their respective lights. All additional lights to be provided at the contract price. The city reserves the right to reject any and all bids.

A. P. SHAWVER,
City Civil Engineer.

MUNICIPALITY OF BOMBAY.

ELECTRIC LIGHTING.

NOTICE.

SEALED TENDERS will be received by the MUNICIPAL COMMISSIONER for the City of Bombay up to 1 P. M., on Monday, the 16th day of February, 1891, for experimental lighting by Electricity of certain streets of the City of Bombay for a period of two years.

2. Forms of tender and schedule of conditions and a sketch of the portion of the City showing the streets to be lighted may, on payment of Five Dollars, be obtained from CHARLES HALLETT CLARK, Washington Building, No. 1 Broadway, Rooms 209 and 210, New York, who will, on application, give any further information that may be required.

3. Tenders must be accompanied by a deposit of Rupees One thousand in cash (not to bear interest) or in Public Securities for that amount, to be paid to the Chief Accountant of the Municipality of Bombay, which will be forfeited to the Corporation in case of refusal to sign the Contract embodying the conditions mentioned in the Schedule above referred to.

4. A further payment to make the total deposit equivalent to 5 per cent on the contract amount will have to be made by the Tenderer, whose tender may be accepted before signing the Contract.

5. The Municipal Commissioner does not bind himself to accept the lowest or any tender.

By order of the Municipal Commissioner,
RIENZI WALTON,
Executive Engineer, Municipality.

EXECUTIVE ENGINEER'S OFFICE,
BOMBAY MUNICIPALITY,
BOMBAY, 13th October, 1890.

F. Z. MAGUIRE,
ELECTRICAL SECURITIES, ETC.,
18 WALL STREET,
NEW YORK.

ELECTRIC AND STREET RAILWAY PROPERTIES BOUGHT AND SOLD.

Norway Iron Frame
ELECTRIC BELL
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632 ARCH ST., PHILA.

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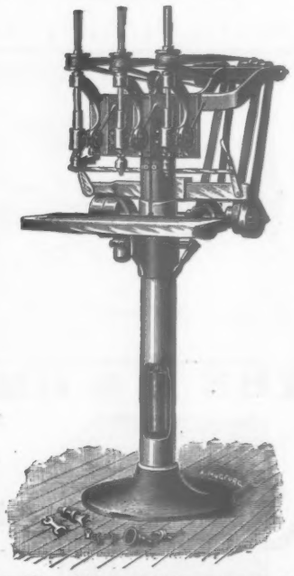

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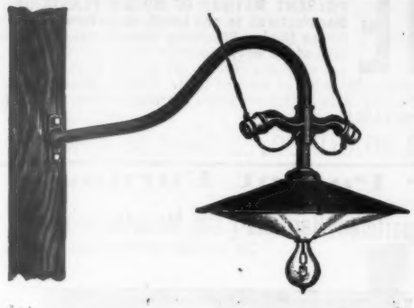

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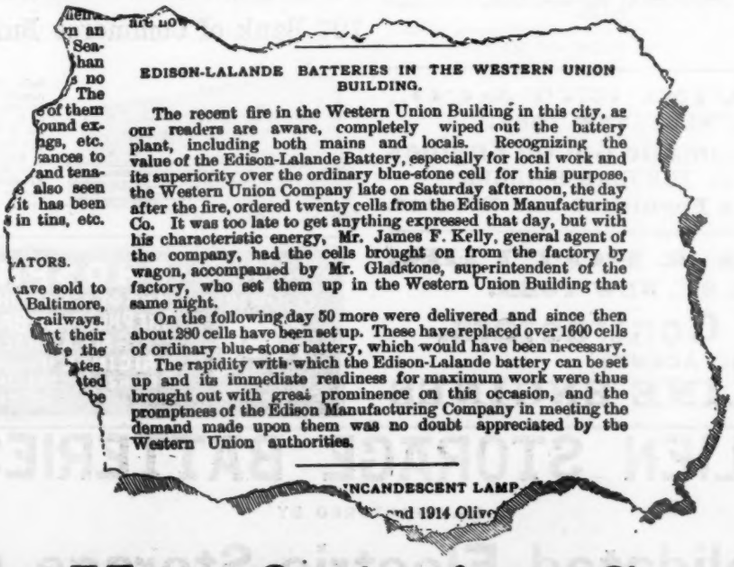

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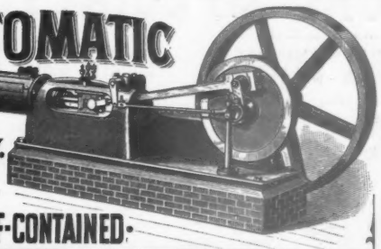

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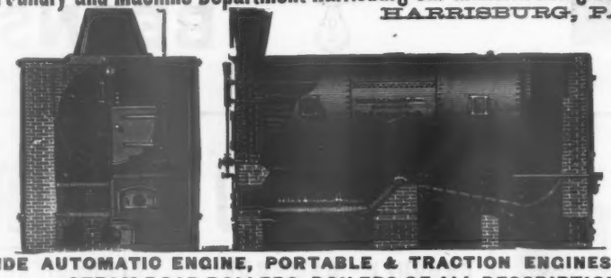

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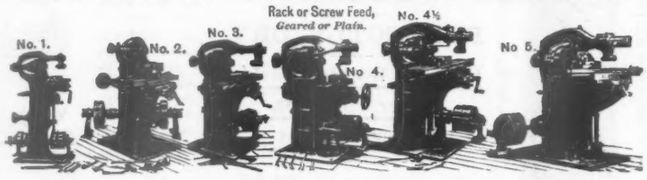

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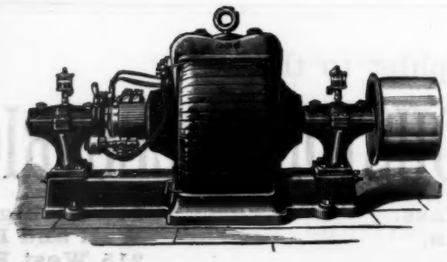

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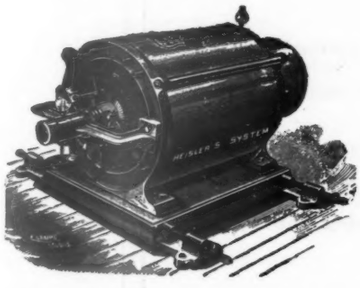

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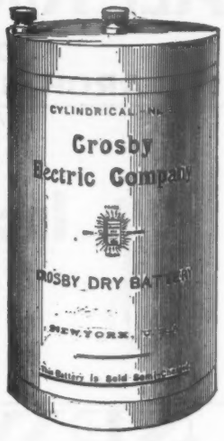

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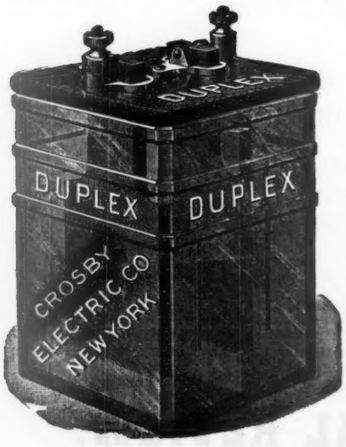
THIS IMPROVEMENT CAN BE APPLIED TO ALL FORMS OF BLUE STONE JARS AT PRESENT IN USE.

THE DUPLEX.

Its two cells occupy only the space of one, thereby giving a voltage in the space of one cell, equal to that obtained by any other two cells requiring double the space.



For Housework,
Bells,
Burglar Alarms,
Etc.
No Climbing Salts.
Always Clean.
Recuperates Quickly.
Large Zinc Surface.
Is rapidly taking the place of all other Open Circuit Liquid Batteries.

THE ECLIPSE.

Intended for Close Circuit Work.
Will Not Polarize.
Pure Water only Necessary to Charge It.
The Simplest and Cleanest Close Circuit Battery in the World.

No Fumes.
No Odor.
For Small Motors.
Small Lamps.
For Doctors' and Dentists' Use.
Induction Coils, Etc., and all purposes where a Constant Current is required for continuous or intermittent work.